



March 10, 2015

Mr. James Johnson  
On-Scene Coordinator  
U.S. Environmental Protection Agency, Region 7  
11201 Renner Boulevard  
Lenexa, Kansas 66219

**Subject: Data Deliverable Package 08**  
**West Lake Landfill Site, Bridgeton, Missouri**  
**CERCLIS ID: MOD079900932**  
**EPA Region 7, START 4, Contract No. EP-S7-13-06, Task Order No. 0058**  
**Task Monitor: James Johnson, On-Scene Coordinator**

Dear Mr. Johnson:


Tetra Tech, Inc. is submitting the following analytical laboratory reports with associated data validation reports for sampling at locations off-site of the West Lake Landfill Site in Bridgeton, Missouri.

<u>Sample Delivery Group</u>	<u>Analysis Type</u>	<u>Sample Collection Date</u>
J2440	Volatile Organic Compounds	12/04/2014
J9958	Alpha-emitting Ra and Isotopic U/Th	12/17/2014
J9986	Alpha-emitting Ra and Isotopic U/Th	12/23/2014
J10012	Alpha-emitting Ra and Isotopic U/Th	12/31/2014
J10012	Gamma scan and gross alpha/beta	12/31/2014
J10086	Alpha-emitting Ra and Isotopic U/Th	01/06/2015
J10086	Gamma scan and gross alpha/beta	01/06/2015
J10181	Alpha-emitting Ra and Isotopic U/Th	01/14/2015
J10273	Alpha-emitting Ra and Isotopic U/Th	01/21/2015
J10333	Gamma scan and gross alpha/beta	01/28/2015
60187128	Volatile Organic Compounds	01/28/2015
P15000232	Hydrogen Sulfide	01/19/2015
P15000342	Hydrogen Sulfide	01/28/2015
P15000481	Hydrogen Sulfide	02/04/2015

If you have any questions or comments, please contact Rob Monnig at (816) 412-1775.

Sincerely,

  
Dave Kinroth  
START Project Manager

  
Ted Faile, PG, CHMM  
START Program Manager

Enclosures

cc: Debra Dorsey, START Project Officer (cover letter only)

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March 6, 2015

Mr. James Johnson  
On-Scene Coordinator  
U.S. Environmental Protection Agency, Region 7  
11201 Renner Boulevard  
Lenexa, Kansas 66219

**Subject: Interim Data Summary of AreaRAE Measurements During Ongoing Baseline  
Off-Site Air Monitoring  
West Lake Landfill Site, Bridgeton, Missouri  
CERCLIS ID: MOD079900932  
EPA Region 7, START 4, Contract No. EP-S7-13-06, Task Order No. 0058  
Task Monitor: James Johnson, On-Scene Coordinator**

Dear Mr. Johnson:

Tetra Tech, Inc. is submitting the attached Interim Data Summary Report regarding carbon monoxide, hydrogen sulfide, and sulfur dioxide measurements by RAE Systems, Inc., AreaRAE instruments during ongoing air monitoring at locations off site of the West Lake Landfill site (WLLS) in Bridgeton, Missouri. This monitoring is occurring during a baseline period prior to start of construction of an isolation barrier at WLLS. If you have any questions or comments, please contact me at (816) 412-1775.

Sincerely,

A handwritten signature in blue ink, appearing to read 'Rob Monnig'.

Robert Monnig, PE  
START Project Manager

A handwritten signature in blue ink, appearing to read 'Ted Faile'.

Ted Faile, PG, CHMM  
START Program Manager

Enclosures

cc: Debra Dorsey, START Project Officer (cover letter only)

**Tetra Tech, Inc.**  
**DATA VALIDATION REPORT**  
**LEVEL II**

Site: West Lake Landfill Site, Bridgeton, Missouri

Laboratory: TestAmerica Laboratories, Inc. (Knoxville, Tennessee)

Data Reviewer: Harry Ellis, Tetra Tech, Inc. (Tetra Tech)

Review Date: February 24, 2015

Sample Delivery Group (SDG): J2440

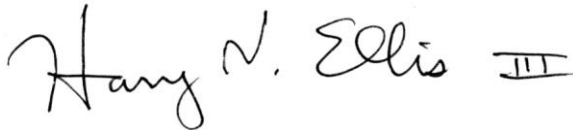
Sample Numbers: WAA-01-SU-PS-20141204, WAA-02-SU-PS-20141204, WAA-03-SU-PS-20141204, WAA-04-SU-PS-20141204, WAA-04-SU-DU-20141204, WAA-05-SU-PS-20141204, and WAA-00-SU-TB-20141204

Matrix / Number of Samples: 5 Air Samples, 1 Field Duplicate Sample, and 1 Trip Blank

The data were qualified according to the U.S. Environmental Protection Agency (EPA) Region 7 documents entitled "Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review" (9240.1-48), June 2008. In addition, the Tetra Tech document "Review of Data Packages from Subcontracted Laboratories" (February 2002) was used along with other criteria specified in the applicable methods.

The review was intended to identify problems and quality control (QC) deficiencies that were readily apparent from the summary data package. The following sections discuss any problems or deficiencies that were found, and data qualifications applied because of non-compliant QC. The data review was limited to the available field and laboratory QC information submitted with the project-specific data package.

I, Harry Ellis, certify that all data validation criteria outlined in the above-referenced documents were assessed, and any qualifications made to the data accorded with those documents.



24 February 2015

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Certified by Harry Ellis, Chemist

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Date

## DATA VALIDATION QUALIFIERS

- U** — The analyte was not detected above the reported sample quantitation limit.
- J** — The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.
- UJ** — The analyte was not detected above the reported sample quantitation limit, which is estimated.
- R** — The sample results are rejected due to serious deficiencies in the ability to analyze the sample and meet QC criteria. Presence or absence of the analyte cannot be verified.



## **DATA ASSESSMENT**

Sample delivery group (SDG) J2440 included five (5) environmental air (passivated canister) samples and two (2) QC samples (a field duplicate and a trip blank). Samples were analyzed for volatile organic compounds via EPA Air Method TO-15. The following summarizes the data validation that was performed.

### **VOLATILE ORGANIC COMPOUND ANALYSIS**

#### **I. Holding Time and Chain of Custody (COC) Requirements**

The samples were received by the laboratory and analyzed within the established holding time of 30 days from sample collection by canister to analysis. No data were qualified.

#### **II. Matrix Spike/Matrix Spike Duplicate (MS/MSD)**

MS/MSD analyses are not practical for air analyses. Satisfactory LCS and field duplicate sample analysis provided adequate data on precision and accuracy. No qualifications were applied.

#### **III. Blanks**

The laboratory (method) blank yielded low concentrations (less than the reporting limit) of the common laboratory contaminant methylene chloride. The similar concentrations of methylene chloride in the field blank and most other field samples were qualified as laboratory artifacts and flagged "U". The one result for methylene chloride above the reporting limit was qualified as estimated, possibly biased high, and flagged "J".

#### **IV. Laboratory Control Sample (LCS)**

Most percent recoveries from the LCS analysis were within the established control limits. However, recoveries of 1,1,2-trichloro-1,2,2-trifluoroethane (131 percent, versus QC limits of 70 to 130 percent) and 1,1-dichloroethene (133 percent, versus the same limits) exceeded QC limits. The detected results for those two analytes were qualified as estimated, possibly biased high, and flagged "J".

#### **V. Surrogates**

All surrogate recoveries were within QC limits. No qualifications were applied.

#### **VI. Comments**

Many detected results were less than reporting limits, which correspond to the lowest calibration standard. The laboratory correctly reported these extrapolations as estimated (flagged "J"). All results in the field duplicate pair were quite similar.

#### **VII. Overall Assessment of Data**

Overall data quality is acceptable, with few qualifications added. All data are usable as qualified for their intended purposes.

# TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

## ANALYTICAL REPORT

TestAmerica Laboratories, Inc.

TestAmerica Knoxville  
5815 Middlebrook Pike  
Knoxville, TN 37921  
Tel: (865)291-3000

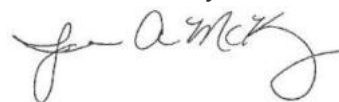
TestAmerica Job ID: 140-2440-1

Client Project/Site: West Lake Landfill

For:

Tetra Tech EM Inc.  
415 Oak Street  
Kansas City, Missouri 64106

Attn: Ms. Emily Fisher



Authorized for release by:  
12/17/2014 12:37:24 PM

Jamie McKinney, Senior Project Manager  
(865)291-3000  
[jamie.mckinney@testamericainc.com](mailto:jamie.mckinney@testamericainc.com)

### LINKS

Review your project  
results through

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Have a Question?



Visit us at:

[www.testamericainc.com](http://www.testamericainc.com)

*The test results in this report meet all 2003 NELAC and 2009 TNI requirements for accredited parameters, exceptions are noted in this report. This report may not be reproduced except in full, and with written approval from the laboratory. For questions please contact the Project Manager at the e-mail address or telephone number listed on this page.*

*This report has been electronically signed and authorized by the signatory. Electronic signature is intended to be the legally binding equivalent of a traditionally handwritten signature.*

*Results relate only to the items tested and the sample(s) as received by the laboratory.*

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## Definitions/Glossary

Client: Tetra Tech EM Inc.  
Project/Site: West Lake Landfill

TestAmerica Job ID: 140-2440-1

### Qualifiers

#### Air - GC/MS VOA

Qualifier	Qualifier Description
*	LCS or LCSD exceeds the control limits
J	Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.
B	Compound was found in the blank and sample.

### Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
α	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
CFL	Contains Free Liquid
CNF	Contains no Free Liquid
DER	Duplicate error ratio (normalized absolute difference)
Dil Fac	Dilution Factor
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision level concentration
MDA	Minimum detectable activity
EDL	Estimated Detection Limit
MDC	Minimum detectable concentration
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
NC	Not Calculated
ND	Not detected at the reporting limit (or MDL or EDL if shown)
PQL	Practical Quantitation Limit
QC	Quality Control
RER	Relative error ratio
RL	Reporting Limit or Requested Limit (Radiochemistry)
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)

## Case Narrative

Client: Tetra Tech EM Inc.  
Project/Site: West Lake Landfill

TestAmerica Job ID: 140-2440-1

**Job ID: 140-2440-1**

**Laboratory: TestAmerica Knoxville**

### Narrative

#### Job Narrative 140-2440-1

### Comments

No additional comments.

### Receipt

The samples were received on 12/9/2014 10:15 AM; the samples arrived in good condition, properly preserved and, where required, on ice.

### Air - GC/MS VOA

Method(s) TO 14A, TO 15 LL, TO-14A, TO-15: EPA methods TO-14A and TO-15 specify the use of humidified "zero air" as the blank reagent for canister cleaning, instrument calibration and sample analysis. Ultra-high purity humidified nitrogen from a cryogenic reservoir is used in place of "zero air" by TestAmerica Knoxville.

Method(s) TO-15: The following analyte(s) recovered outside control limits for the LCS associated with batch 2031: 1,1,-dichloroethene and 1,1,2-trichloro-1,2,2-trifluoroethane. This is not indicative of a systematic control problem because these were random marginal exceedances. Qualified results have been reported.

The continuing calibration verification (CCV) associated with batch 2031 exhibited % difference of > 30% for the following analyte(s) 1,1-dichloroethene, 1,1,2-trichloro-1,2,2-trifluoroethane and chloromethane, however the results were within the LCS acceptance limits. The EPA method requires that all target analytes in the continuing calibration verification standard be within 30% difference from the initial calibration. According to the laboratory standard operating procedure, the continuing calibration is acceptable if it meets the laboratory control sample acceptance criteria.

No additional analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

# Detection Summary

Client: Tetra Tech EM Inc.  
Project/Site: West Lake Landfill

TestAmerica Job ID: 140-2440-1

Client Sample ID: WAA-01-SU-PS-20141204

Lab Sample ID: 140-2440-1

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
1,1,2-Trichloro-1,2,2-trifluoroethane	0.094	J *	0.20	0.031	ppb v/v	1		TO-15	Total/NA
Benzene	0.24		0.20	0.056	ppb v/v	1		TO-15	Total/NA
Carbon tetrachloride	0.096	J	0.20	0.038	ppb v/v	1		TO-15	Total/NA
Chloromethane	0.70		0.50	0.16	ppb v/v	1		TO-15	Total/NA
Dichlorodifluoromethane	0.46		0.20	0.068	ppb v/v	1		TO-15	Total/NA
Methylene Chloride	0.39	J B	0.50	0.13	ppb v/v	1		TO-15	Total/NA
Toluene	0.28		0.20	0.12	ppb v/v	1		TO-15	Total/NA
Trichlorofluoromethane	0.21		0.20	0.024	ppb v/v	1		TO-15	Total/NA
Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
1,1,2-Trichloro-1,2,2-trifluoroethane	0.72	J *	1.5	0.24	ug/m3	1		TO-15	Total/NA
Benzene	0.76		0.64	0.18	ug/m3	1		TO-15	Total/NA
Carbon tetrachloride	0.60	J	1.3	0.24	ug/m3	1		TO-15	Total/NA
Chloromethane	1.4		1.0	0.33	ug/m3	1		TO-15	Total/NA
Dichlorodifluoromethane	2.3		0.99	0.34	ug/m3	1		TO-15	Total/NA
Methylene Chloride	1.4	J B	1.7	0.45	ug/m3	1		TO-15	Total/NA
Toluene	1.0		0.75	0.45	ug/m3	1		TO-15	Total/NA
Trichlorofluoromethane	1.2		1.1	0.13	ug/m3	1		TO-15	Total/NA

Client Sample ID: WAA-02-SU-PS-20141204

Lab Sample ID: 140-2440-2

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
1,1,2-Trichloro-1,2,2-trifluoroethane	0.088	J *	0.20	0.031	ppb v/v	1		TO-15	Total/NA
Benzene	0.24		0.20	0.056	ppb v/v	1		TO-15	Total/NA
Carbon tetrachloride	0.070	J	0.20	0.038	ppb v/v	1		TO-15	Total/NA
Chloromethane	1.0		0.50	0.16	ppb v/v	1		TO-15	Total/NA
Dichlorodifluoromethane	0.51		0.20	0.068	ppb v/v	1		TO-15	Total/NA
Methylene Chloride	0.43	J B	0.50	0.13	ppb v/v	1		TO-15	Total/NA
Toluene	0.25		0.20	0.12	ppb v/v	1		TO-15	Total/NA
Trichlorofluoromethane	0.23		0.20	0.024	ppb v/v	1		TO-15	Total/NA
Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
1,1,2-Trichloro-1,2,2-trifluoroethane	0.68	J *	1.5	0.24	ug/m3	1		TO-15	Total/NA
Benzene	0.76		0.64	0.18	ug/m3	1		TO-15	Total/NA
Carbon tetrachloride	0.44	J	1.3	0.24	ug/m3	1		TO-15	Total/NA
Chloromethane	2.1		1.0	0.33	ug/m3	1		TO-15	Total/NA
Dichlorodifluoromethane	2.5		0.99	0.34	ug/m3	1		TO-15	Total/NA
Methylene Chloride	1.5	J B	1.7	0.45	ug/m3	1		TO-15	Total/NA
Toluene	0.96		0.75	0.45	ug/m3	1		TO-15	Total/NA
Trichlorofluoromethane	1.3		1.1	0.13	ug/m3	1		TO-15	Total/NA

Client Sample ID: WAA-03-SU-PS-20141204

Lab Sample ID: 140-2440-3

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
1,1,2-Trichloro-1,2,2-trifluoroethane	0.12	J *	0.20	0.031	ppb v/v	1		TO-15	Total/NA
1,2,4-Trimethylbenzene	0.12	J	0.20	0.063	ppb v/v	1		TO-15	Total/NA
Benzene	0.27		0.20	0.056	ppb v/v	1		TO-15	Total/NA
Carbon tetrachloride	0.11	J	0.20	0.038	ppb v/v	1		TO-15	Total/NA
Chloromethane	1.0		0.50	0.16	ppb v/v	1		TO-15	Total/NA
Dichlorodifluoromethane	0.55		0.20	0.068	ppb v/v	1		TO-15	Total/NA
Ethylbenzene	0.069	J	0.20	0.068	ppb v/v	1		TO-15	Total/NA
Methylene Chloride	0.72	B	0.50	0.13	ppb v/v	1		TO-15	Total/NA

This Detection Summary does not include radiochemical test results.

TestAmerica Knoxville

## Detection Summary

Client: Tetra Tech EM Inc.  
Project/Site: West Lake Landfill

TestAmerica Job ID: 140-2440-1

**Client Sample ID: WAA-03-SU-PS-20141204 (Continued)**

**Lab Sample ID: 140-2440-3**

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
m-Xylene & p-Xylene	0.16	J	0.20	0.12	ppb v/v	1		TO-15	Total/NA
o-Xylene	0.074	J	0.20	0.061	ppb v/v	1		TO-15	Total/NA
Toluene	0.54		0.20	0.12	ppb v/v	1		TO-15	Total/NA
Trichlorofluoromethane	0.25		0.20	0.024	ppb v/v	1		TO-15	Total/NA
Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
1,1,2-Trichloro-1,2,2-trifluoroethane	0.89	J *	1.5	0.24	ug/m3	1		TO-15	Total/NA
1,2,4-Trimethylbenzene	0.60	J	0.98	0.31	ug/m3	1		TO-15	Total/NA
Benzene	0.85		0.64	0.18	ug/m3	1		TO-15	Total/NA
Carbon tetrachloride	0.72	J	1.3	0.24	ug/m3	1		TO-15	Total/NA
Chloromethane	2.1		1.0	0.33	ug/m3	1		TO-15	Total/NA
Dichlorodifluoromethane	2.7		0.99	0.34	ug/m3	1		TO-15	Total/NA
Ethylbenzene	0.30	J	0.87	0.30	ug/m3	1		TO-15	Total/NA
Methylene Chloride	2.5	B	1.7	0.45	ug/m3	1		TO-15	Total/NA
m-Xylene & p-Xylene	0.69	J	0.87	0.52	ug/m3	1		TO-15	Total/NA
o-Xylene	0.32	J	0.87	0.26	ug/m3	1		TO-15	Total/NA
Toluene	2.0		0.75	0.45	ug/m3	1		TO-15	Total/NA
Trichlorofluoromethane	1.4		1.1	0.13	ug/m3	1		TO-15	Total/NA

**Client Sample ID: WAA-04-SU-PS-20141204**

**Lab Sample ID: 140-2440-4**

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
1,1,2-Trichloro-1,2,2-trifluoroethane	0.083	J *	0.20	0.031	ppb v/v	1.48		TO-15	Total/NA
1,2-Dichloroethane	0.051	J	0.20	0.047	ppb v/v	1.48		TO-15	Total/NA
Benzene	0.25		0.20	0.056	ppb v/v	1.48		TO-15	Total/NA
Carbon tetrachloride	0.087	J	0.20	0.038	ppb v/v	1.48		TO-15	Total/NA
Chloromethane	1.0		0.50	0.16	ppb v/v	1.48		TO-15	Total/NA
Dichlorodifluoromethane	0.43		0.20	0.068	ppb v/v	1.48		TO-15	Total/NA
Methylene Chloride	0.36	J B	0.50	0.13	ppb v/v	1.48		TO-15	Total/NA
o-Xylene	0.064	J	0.20	0.061	ppb v/v	1.48		TO-15	Total/NA
Toluene	0.23		0.20	0.12	ppb v/v	1.48		TO-15	Total/NA
Trichlorofluoromethane	0.20		0.20	0.024	ppb v/v	1.48		TO-15	Total/NA
Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
1,1,2-Trichloro-1,2,2-trifluoroethane	0.63	J *	1.5	0.24	ug/m3	1.48		TO-15	Total/NA
1,2-Dichloroethane	0.21	J	0.81	0.19	ug/m3	1.48		TO-15	Total/NA
Benzene	0.80		0.64	0.18	ug/m3	1.48		TO-15	Total/NA
Carbon tetrachloride	0.54	J	1.3	0.24	ug/m3	1.48		TO-15	Total/NA
Chloromethane	2.1		1.0	0.33	ug/m3	1.48		TO-15	Total/NA
Dichlorodifluoromethane	2.1		0.99	0.34	ug/m3	1.48		TO-15	Total/NA
Methylene Chloride	1.2	J B	1.7	0.45	ug/m3	1.48		TO-15	Total/NA
o-Xylene	0.28	J	0.87	0.26	ug/m3	1.48		TO-15	Total/NA
Toluene	0.86		0.75	0.45	ug/m3	1.48		TO-15	Total/NA
Trichlorofluoromethane	1.1		1.1	0.13	ug/m3	1.48		TO-15	Total/NA

**Client Sample ID: WAA-05-SU-PS-20141204**

**Lab Sample ID: 140-2440-5**

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
1,1,2-Trichloro-1,2,2-trifluoroethane	0.087	J *	0.20	0.031	ppb v/v	1		TO-15	Total/NA
Benzene	0.27		0.20	0.056	ppb v/v	1		TO-15	Total/NA
Carbon tetrachloride	0.079	J	0.20	0.038	ppb v/v	1		TO-15	Total/NA
Chloromethane	1.1		0.50	0.16	ppb v/v	1		TO-15	Total/NA

This Detection Summary does not include radiochemical test results.

TestAmerica Knoxville

# Detection Summary

Client: Tetra Tech EM Inc.  
Project/Site: West Lake Landfill

TestAmerica Job ID: 140-2440-1

## Client Sample ID: WAA-05-SU-PS-20141204 (Continued)

Lab Sample ID: 140-2440-5

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Dichlorodifluoromethane	0.43		0.20	0.068	ppb v/v	1		TO-15	Total/NA
Methylene Chloride	0.31	J B	0.50	0.13	ppb v/v	1		TO-15	Total/NA
Toluene	0.25		0.20	0.12	ppb v/v	1		TO-15	Total/NA
Trichloroethene	0.053	J	0.20	0.036	ppb v/v	1		TO-15	Total/NA
Trichlorofluoromethane	0.22		0.20	0.024	ppb v/v	1		TO-15	Total/NA
Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
1,1,2-Trichloro-1,2,2-trifluoroethane	0.67	J *	1.5	0.24	ug/m3	1		TO-15	Total/NA
Benzene	0.87		0.64	0.18	ug/m3	1		TO-15	Total/NA
Carbon tetrachloride	0.50	J	1.3	0.24	ug/m3	1		TO-15	Total/NA
Chloromethane	2.3		1.0	0.33	ug/m3	1		TO-15	Total/NA
Dichlorodifluoromethane	2.1		0.99	0.34	ug/m3	1		TO-15	Total/NA
Methylene Chloride	1.1	J B	1.7	0.45	ug/m3	1		TO-15	Total/NA
Toluene	0.95		0.75	0.45	ug/m3	1		TO-15	Total/NA
Trichloroethene	0.29	J	1.1	0.19	ug/m3	1		TO-15	Total/NA
Trichlorofluoromethane	1.2		1.1	0.13	ug/m3	1		TO-15	Total/NA

## Client Sample ID: WAA-04-SU-DU-20141204

Lab Sample ID: 140-2440-6

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
1,1,2-Trichloro-1,2,2-trifluoroethane	0.088	J *	0.20	0.031	ppb v/v	1		TO-15	Total/NA
Benzene	0.21		0.20	0.056	ppb v/v	1		TO-15	Total/NA
Carbon tetrachloride	0.065	J	0.20	0.038	ppb v/v	1		TO-15	Total/NA
Chloromethane	1.1		0.50	0.16	ppb v/v	1		TO-15	Total/NA
Dichlorodifluoromethane	0.52		0.20	0.068	ppb v/v	1		TO-15	Total/NA
Methylene Chloride	0.35	J B	0.50	0.13	ppb v/v	1		TO-15	Total/NA
Toluene	0.21		0.20	0.12	ppb v/v	1		TO-15	Total/NA
Trichlorofluoromethane	0.24		0.20	0.024	ppb v/v	1		TO-15	Total/NA
Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
1,1,2-Trichloro-1,2,2-trifluoroethane	0.68	J *	1.5	0.24	ug/m3	1		TO-15	Total/NA
Benzene	0.66		0.64	0.18	ug/m3	1		TO-15	Total/NA
Carbon tetrachloride	0.41	J	1.3	0.24	ug/m3	1		TO-15	Total/NA
Chloromethane	2.3		1.0	0.33	ug/m3	1		TO-15	Total/NA
Dichlorodifluoromethane	2.6		0.99	0.34	ug/m3	1		TO-15	Total/NA
Methylene Chloride	1.2	J B	1.7	0.45	ug/m3	1		TO-15	Total/NA
Toluene	0.79		0.75	0.45	ug/m3	1		TO-15	Total/NA
Trichlorofluoromethane	1.4		1.1	0.13	ug/m3	1		TO-15	Total/NA

## Client Sample ID: WAA-00-SU-TB-20141204

Lab Sample ID: 140-2440-7

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Methylene Chloride	0.25	J B	0.50	0.13	ppb v/v	1		TO-15	Total/NA
Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Methylene Chloride	0.85	J B	1.7	0.45	ug/m3	1		TO-15	Total/NA

This Detection Summary does not include radiochemical test results.

TestAmerica Knoxville



# Client Sample Results

Client: Tetra Tech EM Inc.  
Project/Site: West Lake Landfill

TestAmerica Job ID: 140-2440-1

Client Sample ID: WAA-01-SU-PS-20141204

Lab Sample ID: 140-2440-1

Date Collected: 12/04/14 15:46

Matrix: Air

Date Received: 12/09/14 10:15

Sample Container: Summa Canister 6L

## Method: TO-15 - Volatile Organic Compounds in Ambient Air

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1,1-Trichloroethane	ND		0.20	0.030	ppb v/v			12/10/14 21:01	1
1,1,2,2-Tetrachloroethane	ND		0.20	0.061	ppb v/v			12/10/14 21:01	1
1,1,2-Trichloro-1,2,2-trifluoroethane	0.094	J	0.20	0.031	ppb v/v			12/10/14 21:01	1
1,1,2-Trichloroethane	ND		0.20	0.054	ppb v/v			12/10/14 21:01	1
1,1-Dichloroethane	ND		0.20	0.026	ppb v/v			12/10/14 21:01	1
1,1-Dichloroethene	ND		0.20	0.034	ppb v/v			12/10/14 21:01	1
1,2,4-Trichlorobenzene	ND		1.0	0.098	ppb v/v			12/10/14 21:01	1
1,2,4-Trimethylbenzene	ND		0.20	0.063	ppb v/v			12/10/14 21:01	1
1,2-Dichloro-1,1,2,2-tetrafluoroethane	ND		0.20	0.032	ppb v/v			12/10/14 21:01	1
1,2-Dichlorobenzene	ND		0.20	0.070	ppb v/v			12/10/14 21:01	1
1,2-Dichloroethane	ND		0.20	0.047	ppb v/v			12/10/14 21:01	1
1,2-Dichloropropane	ND		0.20	0.052	ppb v/v			12/10/14 21:01	1
1,3,5-Trimethylbenzene	ND		0.20	0.065	ppb v/v			12/10/14 21:01	1
1,3-Dichlorobenzene	ND		0.20	0.065	ppb v/v			12/10/14 21:01	1
1,4-Dichlorobenzene	ND		0.20	0.064	ppb v/v			12/10/14 21:01	1
Benzene	0.24		0.20	0.056	ppb v/v			12/10/14 21:01	1
Benzyl chloride	ND		0.40	0.078	ppb v/v			12/10/14 21:01	1
Bromomethane	ND		0.20	0.032	ppb v/v			12/10/14 21:01	1
Carbon tetrachloride	0.096	J	0.20	0.038	ppb v/v			12/10/14 21:01	1
Chlorobenzene	ND		0.20	0.049	ppb v/v			12/10/14 21:01	1
Chloroethane	ND		0.20	0.035	ppb v/v			12/10/14 21:01	1
Chloroform	ND		0.20	0.038	ppb v/v			12/10/14 21:01	1
Chloromethane	0.70		0.50	0.16	ppb v/v			12/10/14 21:01	1
cis-1,2-Dichloroethene	ND		0.20	0.060	ppb v/v			12/10/14 21:01	1
cis-1,3-Dichloropropene	ND		0.20	0.074	ppb v/v			12/10/14 21:01	1
Dichlorodifluoromethane	0.46		0.20	0.068	ppb v/v			12/10/14 21:01	1
Ethylbenzene	ND		0.20	0.068	ppb v/v			12/10/14 21:01	1
1,2-Dibromoethane (EDB)	ND		0.20	0.044	ppb v/v			12/10/14 21:01	1
Hexachlorobutadiene	ND		1.0	0.078	ppb v/v			12/10/14 21:01	1
Methylene Chloride	0.39	J B U	0.50	0.13	ppb v/v			12/10/14 21:01	1
m-Xylene & p-Xylene	ND		0.20	0.12	ppb v/v			12/10/14 21:01	1
o-Xylene	ND		0.20	0.061	ppb v/v			12/10/14 21:01	1
Styrene	ND		0.20	0.058	ppb v/v			12/10/14 21:01	1
Tetrachloroethene	ND		0.20	0.040	ppb v/v			12/10/14 21:01	1
Toluene	0.28		0.20	0.12	ppb v/v			12/10/14 21:01	1
trans-1,3-Dichloropropene	ND		0.20	0.048	ppb v/v			12/10/14 21:01	1
Trichloroethene	ND		0.20	0.036	ppb v/v			12/10/14 21:01	1
Trichlorofluoromethane	0.21		0.20	0.024	ppb v/v			12/10/14 21:01	1
Vinyl chloride	ND		0.20	0.071	ppb v/v			12/10/14 21:01	1

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1,1-Trichloroethane	ND		1.1	0.16	ug/m3			12/10/14 21:01	1
1,1,2,2-Tetrachloroethane	ND		1.4	0.42	ug/m3			12/10/14 21:01	1
1,1,2-Trichloro-1,2,2-trifluoroethane	0.72	J	1.5	0.24	ug/m3			12/10/14 21:01	1
1,1,2-Trichloroethane	ND		1.1	0.29	ug/m3			12/10/14 21:01	1
1,1-Dichloroethane	ND		0.81	0.11	ug/m3			12/10/14 21:01	1
1,1-Dichloroethene	ND		0.79	0.13	ug/m3			12/10/14 21:01	1

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TestAmerica Knoxville

# Client Sample Results

Client: Tetra Tech EM Inc.  
Project/Site: West Lake Landfill

TestAmerica Job ID: 140-2440-1

Client Sample ID: WAA-01-SU-PS-20141204

Lab Sample ID: 140-2440-1

Date Collected: 12/04/14 15:46

Matrix: Air

Date Received: 12/09/14 10:15

Sample Container: Summa Canister 6L

## Method: TO-15 - Volatile Organic Compounds in Ambient Air (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,2,4-Trichlorobenzene	ND		7.4	0.73	ug/m3			12/10/14 21:01	1
1,2,4-Trimethylbenzene	ND		0.98	0.31	ug/m3			12/10/14 21:01	1
1,2-Dichloro-1,1,2,2-tetrafluoroethane	ND		1.4	0.22	ug/m3			12/10/14 21:01	1
1,2-Dichlorobenzene	ND		1.2	0.42	ug/m3			12/10/14 21:01	1
1,2-Dichloroethane	ND		0.81	0.19	ug/m3			12/10/14 21:01	1
1,2-Dichloropropane	ND		0.92	0.24	ug/m3			12/10/14 21:01	1
1,3,5-Trimethylbenzene	ND		0.98	0.32	ug/m3			12/10/14 21:01	1
1,3-Dichlorobenzene	ND		1.2	0.39	ug/m3			12/10/14 21:01	1
1,4-Dichlorobenzene	ND		1.2	0.38	ug/m3			12/10/14 21:01	1
Benzene	0.76		0.64	0.18	ug/m3			12/10/14 21:01	1
Benzyl chloride	ND		2.1	0.40	ug/m3			12/10/14 21:01	1
Bromomethane	ND		0.78	0.12	ug/m3			12/10/14 21:01	1
Carbon tetrachloride	0.60	J	1.3	0.24	ug/m3			12/10/14 21:01	1
Chlorobenzene	ND		0.92	0.23	ug/m3			12/10/14 21:01	1
Chloroethane	ND		0.53	0.092	ug/m3			12/10/14 21:01	1
Chloroform	ND		0.98	0.19	ug/m3			12/10/14 21:01	1
Chloromethane	1.4		1.0	0.33	ug/m3			12/10/14 21:01	1
cis-1,2-Dichloroethene	ND		0.79	0.24	ug/m3			12/10/14 21:01	1
cis-1,3-Dichloropropene	ND		0.91	0.34	ug/m3			12/10/14 21:01	1
Dichlorodifluoromethane	2.3		0.99	0.34	ug/m3			12/10/14 21:01	1
Ethylbenzene	ND		0.87	0.30	ug/m3			12/10/14 21:01	1
1,2-Dibromoethane (EDB)	ND		1.5	0.34	ug/m3			12/10/14 21:01	1
Hexachlorobutadiene	ND		1.1	0.83	ug/m3			12/10/14 21:01	1
Methylene Chloride	1.4	J, U	1.7	0.45	ug/m3			12/10/14 21:01	1
m-Xylene & p-Xylene	ND		0.87	0.52	ug/m3			12/10/14 21:01	1
o-Xylene	ND		0.87	0.26	ug/m3			12/10/14 21:01	1
Styrene	ND		0.85	0.25	ug/m3			12/10/14 21:01	1
Tetrachloroethene	ND		1.4	0.27	ug/m3			12/10/14 21:01	1
Toluene	1.0		0.75	0.45	ug/m3			12/10/14 21:01	1
trans-1,3-Dichloropropene	ND		0.91	0.22	ug/m3			12/10/14 21:01	1
Trichloroethene	ND		1.1	0.19	ug/m3			12/10/14 21:01	1
Trichlorofluoromethane	1.2		1.1	0.13	ug/m3			12/10/14 21:01	1
Vinyl chloride	ND		0.51	0.18	ug/m3			12/10/14 21:01	1

Surrogate	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
4-Bromofluorobenzene (Sut)	100		60 - 140		12/10/14 21:01	1

Client Sample ID: WAA-02-SU-PS-20141204

Lab Sample ID: 140-2440-2

Date Collected: 12/04/14 14:27

Matrix: Air

Date Received: 12/09/14 10:15

Sample Container: Summa Canister 6L

## Method: TO-15 - Volatile Organic Compounds in Ambient Air

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1,1-Trichloroethane	ND		0.20	0.030	ppb v/v			12/10/14 22:26	1
1,1,2,2-Tetrachloroethane	ND		0.20	0.081	ppb v/v			12/10/14 22:26	1
1,1,2-Trichloro-1,2,2-trifluoroethane	0.088	J	0.20	0.031	ppb v/v			12/10/14 22:26	1
1,1,2-Trichloroethane	ND		0.20	0.054	ppb v/v			12/10/14 22:26	1

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TestAmerica Knoxville

# Client Sample Results

Client: Tetra Tech EM Inc.  
Project/Site: West Lake Landfill

TestAmerica Job ID: 140-2440-1

Client Sample ID: WAA-02-SU-PS-20141204

Lab Sample ID: 140-2440-2

Date Collected: 12/04/14 14:27

Matrix: Air

Date Received: 12/09/14 10:15

Sample Container: Summa Canister 6L

## Method: TO-15 - Volatile Organic Compounds in Ambient Air (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1-Dichloroethane	ND		0.20	0.026	ppb v/v			12/10/14 22:26	1
1,1-Dichloroethene	ND	*	0.20	0.034	ppb v/v			12/10/14 22:26	1
1,2,4-Trichlorobenzene	ND		1.0	0.098	ppb v/v			12/10/14 22:26	1
1,2,4-Trimethylbenzene	ND		0.20	0.063	ppb v/v			12/10/14 22:26	1
1,2-Dichloro-1,1,2,2-tetrafluoroethane	ND		0.20	0.032	ppb v/v			12/10/14 22:26	1
1,2-Dichlorobenzene	ND		0.20	0.070	ppb v/v			12/10/14 22:26	1
1,2-Dichloroethane	ND		0.20	0.047	ppb v/v			12/10/14 22:26	1
1,2-Dichloropropane	ND		0.20	0.052	ppb v/v			12/10/14 22:26	1
1,3,5-Trimethylbenzene	ND		0.20	0.065	ppb v/v			12/10/14 22:26	1
1,3-Dichlorobenzene	ND		0.20	0.065	ppb v/v			12/10/14 22:26	1
1,4-Dichlorobenzene	ND		0.20	0.064	ppb v/v			12/10/14 22:26	1
Benzene	0.24		0.20	0.056	ppb v/v			12/10/14 22:26	1
Benzyl chloride	ND		0.40	0.078	ppb v/v			12/10/14 22:26	1
Bromomethane	ND		0.20	0.032	ppb v/v			12/10/14 22:26	1
Carbon tetrachloride	0.070	J	0.20	0.038	ppb v/v			12/10/14 22:26	1
Chlorobenzene	ND		0.20	0.049	ppb v/v			12/10/14 22:26	1
Chloroethane	ND		0.20	0.035	ppb v/v			12/10/14 22:26	1
Chloroform	ND		0.20	0.038	ppb v/v			12/10/14 22:26	1
Chloromethane	1.0		0.50	0.16	ppb v/v			12/10/14 22:26	1
cis-1,2-Dichloroethene	ND		0.20	0.060	ppb v/v			12/10/14 22:26	1
cis-1,3-Dichloropropene	ND		0.20	0.074	ppb v/v			12/10/14 22:26	1
Dichlorodifluoromethane	0.51		0.20	0.066	ppb v/v			12/10/14 22:26	1
Ethylbenzene	ND		0.20	0.068	ppb v/v			12/10/14 22:26	1
1,2-Dibromoethane (EDB)	ND		0.20	0.044	ppb v/v			12/10/14 22:26	1
Hexachlorobutadiene	ND		1.0	0.078	ppb v/v			12/10/14 22:26	1
Methylene Chloride	0.43	J B 4	0.50	0.13	ppb v/v			12/10/14 22:26	1
m-Xylene & p-Xylene	ND		0.20	0.12	ppb v/v			12/10/14 22:26	1
o-Xylene	ND		0.20	0.061	ppb v/v			12/10/14 22:26	1
Styrene	ND		0.20	0.058	ppb v/v			12/10/14 22:26	1
Tetrachloroethene	ND		0.20	0.040	ppb v/v			12/10/14 22:26	1
Toluene	0.25		0.20	0.12	ppb v/v			12/10/14 22:26	1
trans-1,3-Dichloropropene	ND		0.20	0.048	ppb v/v			12/10/14 22:26	1
Trichloroethene	ND		0.20	0.036	ppb v/v			12/10/14 22:26	1
Trichlorofluoromethane	0.23		0.20	0.024	ppb v/v			12/10/14 22:26	1
Vinyl chloride	ND		0.20	0.071	ppb v/v			12/10/14 22:26	1

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1,1-Trichloroethane	ND		1.1	0.16	ug/m3			12/10/14 22:26	1
1,1,1,2-Tetrachloroethane	ND		1.4	0.42	ug/m3			12/10/14 22:26	1
1,1,2-Trichloro-1,2,2-trifluoroethane	0.68	3	1.5	0.24	ug/m3			12/10/14 22:26	1
1,1,2-Trichloroethane	ND		1.1	0.29	ug/m3			12/10/14 22:26	1
1,1-Dichloroethane	ND		0.81	0.11	ug/m3			12/10/14 22:26	1
1,1-Dichloroethene	ND	*	0.79	0.13	ug/m3			12/10/14 22:26	1
1,2,4-Trichlorobenzene	ND		7.4	0.73	ug/m3			12/10/14 22:26	1
1,2,4-Trimethylbenzene	ND		0.98	0.31	ug/m3			12/10/14 22:26	1
1,2-Dichloro-1,1,2,2-tetrafluoroethane	ND		1.4	0.22	ug/m3			12/10/14 22:26	1
1,2-Dichlorobenzene	ND		1.2	0.42	ug/m3			12/10/14 22:26	1
1,2-Dichloroethane	ND		0.81	0.19	ug/m3			12/10/14 22:26	1

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TestAmerica Knoxville

# Client Sample Results

Client: Tetra Tech EM Inc.  
Project/Site: West Lake Landfill

TestAmerica Job ID: 140-2440-1

Client Sample ID: WAA-02-SU-PS-20141204

Lab Sample ID: 140-2440-2

Date Collected: 12/04/14 14:27

Matrix: Air

Date Received: 12/09/14 10:15

Sample Container: Summa Canister 6L

## Method: TO-15 - Volatile Organic Compounds in Ambient Air (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,2-Dichloropropane	ND		0.92	0.24	ug/m3			12/10/14 22:26	1
1,3,5-Trimethylbenzene	ND		0.98	0.32	ug/m3			12/10/14 22:26	1
1,3-Dichlorobenzene	ND		1.2	0.39	ug/m3			12/10/14 22:26	1
1,4-Dichlorobenzene	ND		1.2	0.38	ug/m3			12/10/14 22:26	1
Benzene	0.76		0.64	0.18	ug/m3			12/10/14 22:26	1
Benzyl chloride	ND		2.1	0.40	ug/m3			12/10/14 22:26	1
Bromomethane	ND		0.78	0.12	ug/m3			12/10/14 22:26	1
Carbon tetrachloride	0.44	J	1.3	0.24	ug/m3			12/10/14 22:26	1
Chlorobenzene	ND		0.92	0.23	ug/m3			12/10/14 22:26	1
Chloroethane	ND		0.53	0.092	ug/m3			12/10/14 22:26	1
Chloroform	ND		0.98	0.19	ug/m3			12/10/14 22:26	1
Chloromethane	2.1		1.0	0.33	ug/m3			12/10/14 22:26	1
cis-1,2-Dichloroethene	ND		0.79	0.24	ug/m3			12/10/14 22:26	1
cis-1,3-Dichloropropene	ND		0.91	0.34	ug/m3			12/10/14 22:26	1
Dichlorodifluoromethane	2.5		0.99	0.34	ug/m3			12/10/14 22:26	1
Ethylbenzene	ND		0.87	0.30	ug/m3			12/10/14 22:26	1
1,2-Dibromoethane (EDB)	ND		1.5	0.34	ug/m3			12/10/14 22:26	1
Hexachlorobutadiene	ND		1.1	0.83	ug/m3			12/10/14 22:26	1
Methylene Chloride	4.5	J B u	1.7	0.45	ug/m3			12/10/14 22:26	1
m-Xylene & p-Xylene	ND		0.87	0.52	ug/m3			12/10/14 22:26	1
o-Xylene	ND		0.87	0.26	ug/m3			12/10/14 22:26	1
Styrene	ND		0.85	0.25	ug/m3			12/10/14 22:26	1
Tetrachloroethene	ND		1.4	0.27	ug/m3			12/10/14 22:26	1
Toluene	0.96		0.75	0.45	ug/m3			12/10/14 22:26	1
trans-1,3-Dichloropropene	ND		0.91	0.22	ug/m3			12/10/14 22:26	1
Trichloroethene	ND		1.1	0.19	ug/m3			12/10/14 22:26	1
Trichlorofluoromethane	1.3		1.1	0.13	ug/m3			12/10/14 22:26	1
Vinyl chloride	ND		0.51	0.18	ug/m3			12/10/14 22:26	1
Surrogate	%Recovery	Qualifier	Limits				Prepared	Analyzed	Dil Fac
4-Bromofluorobenzene (Sum)	102		60 - 140					12/10/14 22:26	1

Client Sample ID: WAA-03-SU-PS-20141204

Lab Sample ID: 140-2440-3

Date Collected: 12/04/14 15:02

Matrix: Air

Date Received: 12/09/14 10:15

Sample Container: Summa Canister 6L

## Method: TO-15 - Volatile Organic Compounds in Ambient Air

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1,1-Trichloroethane	ND		0.20	0.030	ppb v/v			12/10/14 23:09	1
1,1,2,2-Tetrachloroethane	ND		0.20	0.061	ppb v/v			12/10/14 23:09	1
1,1,2-Trichloro-1,2,2-trifluoroethane	0.12	J	0.20	0.031	ppb v/v			12/10/14 23:09	1
1,1,2-Trichloroethane	ND		0.20	0.054	ppb v/v			12/10/14 23:09	1
1,1-Dichloroethane	ND		0.20	0.026	ppb v/v			12/10/14 23:09	1
1,1-Dichloroethene	ND		0.20	0.034	ppb v/v			12/10/14 23:09	1
1,2,4-Trichlorobenzene	ND		1.0	0.098	ppb v/v			12/10/14 23:09	1
1,2,4-Trimethylbenzene	0.12	J	0.20	0.063	ppb v/v			12/10/14 23:09	1
1,2-Dichloro-1,1,2,2-tetrafluoroethane	ND		0.20	0.032	ppb v/v			12/10/14 23:09	1

HVE 24 Feb 15

TestAmerica Knoxville



# Client Sample Results

Client: Tetra Tech EM Inc.  
Project/Site: West Lake Landfill

TestAmerica Job ID: 140-2440-1

Client Sample ID: WAA-03-SU-PS-20141204

Lab Sample ID: 140-2440-3

Date Collected: 12/04/14 15:02

Matrix: Air

Date Received: 12/09/14 10:15

Sample Container: Summa Canister 6L

## Method: TO-15 - Volatile Organic Compounds in Ambient Air (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,2-Dichlorobenzene	ND		0.20	0.070	ppb v/v			12/10/14 23:09	1
1,2-Dichloroethane	ND		0.20	0.047	ppb v/v			12/10/14 23:09	1
1,2-Dichloropropane	ND		0.20	0.052	ppb v/v			12/10/14 23:09	1
1,3,5-Trimethylbenzene	ND		0.20	0.065	ppb v/v			12/10/14 23:09	1
1,3-Dichlorobenzene	ND		0.20	0.065	ppb v/v			12/10/14 23:09	1
1,4-Dichlorobenzene	ND		0.20	0.064	ppb v/v			12/10/14 23:09	1
Benzene	0.27		0.20	0.056	ppb v/v			12/10/14 23:09	1
Benzyl chloride	ND		0.40	0.078	ppb v/v			12/10/14 23:09	1
Bromomethane	ND		0.20	0.032	ppb v/v			12/10/14 23:09	1
Carbon tetrachloride	0.11	J	0.20	0.038	ppb v/v			12/10/14 23:09	1
Chlorobenzene	ND		0.20	0.049	ppb v/v			12/10/14 23:09	1
Chloroethane	ND		0.20	0.035	ppb v/v			12/10/14 23:09	1
Chloroform	ND		0.20	0.038	ppb v/v			12/10/14 23:09	1
Chloromethane	1.0		0.50	0.16	ppb v/v			12/10/14 23:09	1
cis-1,2-Dichloroethene	ND		0.20	0.060	ppb v/v			12/10/14 23:09	1
cis-1,3-Dichloropropene	ND		0.20	0.074	ppb v/v			12/10/14 23:09	1
Dichlorodifluoromethane	0.55		0.20	0.068	ppb v/v			12/10/14 23:09	1
Ethylbenzene	0.069	J	0.20	0.068	ppb v/v			12/10/14 23:09	1
1,2-Dibromoethane (EDB)	ND		0.20	0.044	ppb v/v			12/10/14 23:09	1
Hexachlorobutadiene	ND		1.0	0.078	ppb v/v			12/10/14 23:09	1
Methylene Chloride	0.72	B-J	0.50	0.13	ppb v/v			12/10/14 23:09	1
m-Xylene & p-Xylene	0.16	J	0.20	0.12	ppb v/v			12/10/14 23:09	1
o-Xylene	0.074	J	0.20	0.061	ppb v/v			12/10/14 23:09	1
Styrene	ND		0.20	0.058	ppb v/v			12/10/14 23:09	1
Tetrachloroethene	ND		0.20	0.040	ppb v/v			12/10/14 23:09	1
Toluene	0.54		0.20	0.12	ppb v/v			12/10/14 23:09	1
trans-1,3-Dichloropropene	ND		0.20	0.048	ppb v/v			12/10/14 23:09	1
Trichloroethene	ND		0.20	0.036	ppb v/v			12/10/14 23:09	1
Trichlorofluoromethane	0.25		0.20	0.024	ppb v/v			12/10/14 23:09	1
Vinyl chloride	ND		0.20	0.071	ppb v/v			12/10/14 23:09	1

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1,1-Trichloroethane	ND		1.1	0.16	ug/m3			12/10/14 23:09	1
1,1,2,2-Tetrachloroethane	ND		1.4	0.42	ug/m3			12/10/14 23:09	1
1,1,2-Trichloro-1,2,2-trifluoroethane	0.83	J	1.5	0.24	ug/m3			12/10/14 23:09	1
1,1,2-Trichloroethane	ND		1.1	0.29	ug/m3			12/10/14 23:09	1
1,1-Dichloroethane	ND		0.81	0.11	ug/m3			12/10/14 23:09	1
1,1-Dichloroethene	ND		0.79	0.13	ug/m3			12/10/14 23:09	1
1,2,4-Trichlorobenzene	ND		7.4	0.73	ug/m3			12/10/14 23:09	1
1,2,4-Trimethylbenzene	0.60	J	0.98	0.31	ug/m3			12/10/14 23:09	1
1,2-Dichloro-1,1,2,2-tetrafluoroethane	ND		1.4	0.22	ug/m3			12/10/14 23:09	1
1,2-Dichlorobenzene	ND		1.2	0.42	ug/m3			12/10/14 23:09	1
1,2-Dichloroethane	ND		0.81	0.19	ug/m3			12/10/14 23:09	1
1,2-Dichloropropane	ND		0.92	0.24	ug/m3			12/10/14 23:09	1
1,3,5-Trimethylbenzene	ND		0.98	0.32	ug/m3			12/10/14 23:09	1
1,3-Dichlorobenzene	ND		1.2	0.38	ug/m3			12/10/14 23:09	1
1,4-Dichlorobenzene	ND		1.2	0.38	ug/m3			12/10/14 23:09	1
Benzene	0.85		0.64	0.18	ug/m3			12/10/14 23:09	1

HVE 24 Feb 15

TestAmerica Knoxville

# Client Sample Results

Client: Tetra Tech EM Inc.  
Project/Site: West Lake Landfill

TestAmerica Job ID: 140-2440-1

Client Sample ID: WAA-03-SU-PS-20141204

Lab Sample ID: 140-2440-3

Date Collected: 12/04/14 15:02

Matrix: Air

Date Received: 12/09/14 10:15

Sample Container: Summa Canister 6L

## Method: TO-15 - Volatile Organic Compounds in Ambient Air (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Benzyl chloride	ND		2.1	0.40	ug/m3			12/10/14 23:09	1
Bromomethane	ND		0.78	0.12	ug/m3			12/10/14 23:09	1
Carbon tetrachloride	0.72	J	1.3	0.24	ug/m3			12/10/14 23:09	1
Chlorobenzene	ND		0.92	0.23	ug/m3			12/10/14 23:09	1
Chloroethane	ND		0.53	0.092	ug/m3			12/10/14 23:09	1
Chloroform	ND		0.98	0.19	ug/m3			12/10/14 23:09	1
Chloromethane	2.1		1.0	0.33	ug/m3			12/10/14 23:09	1
cis-1,2-Dichloroethene	ND		0.79	0.24	ug/m3			12/10/14 23:09	1
cis-1,3-Dichloropropene	ND		0.91	0.34	ug/m3			12/10/14 23:09	1
Dichlorodifluoromethane	2.7		0.99	0.34	ug/m3			12/10/14 23:09	1
Ethylbenzene	0.30	J	0.87	0.30	ug/m3			12/10/14 23:09	1
1,2-Dibromoethane (EDB)	ND		1.5	0.34	ug/m3			12/10/14 23:09	1
Hexachlorobutadiene	ND		11	0.83	ug/m3			12/10/14 23:09	1
Methylene Chloride	2.5	-B-J	1.7	0.45	ug/m3			12/10/14 23:09	1
m-Xylene & p-Xylene	0.69	J	0.87	0.52	ug/m3			12/10/14 23:09	1
o-Xylene	0.32	J	0.87	0.26	ug/m3			12/10/14 23:09	1
Styrene	ND		0.85	0.25	ug/m3			12/10/14 23:09	1
Tetrachloroethene	ND		1.4	0.27	ug/m3			12/10/14 23:09	1
Toluene	2.0		0.75	0.45	ug/m3			12/10/14 23:09	1
trans-1,3-Dichloropropene	ND		0.91	0.22	ug/m3			12/10/14 23:09	1
Trichloroethene	ND		1.1	0.19	ug/m3			12/10/14 23:09	1
Trichlorofluoromethane	1.4		1.1	0.13	ug/m3			12/10/14 23:09	1
Vinyl chloride	ND		0.51	0.18	ug/m3			12/10/14 23:09	1
<b>Surrogate</b>	<b>%Recovery</b>	<b>Qualifier</b>	<b>Limits</b>				<b>Prepared</b>	<b>Analyzed</b>	<b>Dil Fac</b>
4-Bromofluorobenzene (Surr)	102		60 - 140					12/10/14 23:09	1

Client Sample ID: WAA-04-SU-PS-20141204

Lab Sample ID: 140-2440-4

Date Collected: 12/04/14 15:20

Matrix: Air

Date Received: 12/09/14 10:15

Sample Container: Summa Canister 6L

## Method: TO-15 - Volatile Organic Compounds in Ambient Air

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1,1-Trichloroethane	ND		0.20	0.030	ppb v/v			12/10/14 23:53	1.48
1,1,2,2-Tetrachloroethane	ND		0.20	0.061	ppb v/v			12/10/14 23:53	1.48
1,1,2-Trichloro-1,2,2-trifluoroethane	0.083	J	0.20	0.031	ppb v/v			12/10/14 23:53	1.48
1,1,2-Trichloroethane	ND		0.20	0.054	ppb v/v			12/10/14 23:53	1.48
1,1-Dichloroethane	ND		0.20	0.026	ppb v/v			12/10/14 23:53	1.48
1,1-Dichloroethene	ND	*	0.20	0.034	ppb v/v			12/10/14 23:53	1.48
1,2,4-Trichlorobenzene	ND		1.0	0.088	ppb v/v			12/10/14 23:53	1.48
1,2,4-Trimethylbenzene	ND		0.20	0.063	ppb v/v			12/10/14 23:53	1.48
1,2-Dichloro-1,1,2,2-tetrafluoroethane	ND		0.20	0.032	ppb v/v			12/10/14 23:53	1.48
1,2-Dichlorobenzene	ND		0.20	0.070	ppb v/v			12/10/14 23:53	1.48
1,2-Dichloroethane	0.051	J	0.20	0.047	ppb v/v			12/10/14 23:53	1.48
1,2-Dichloropropane	ND		0.20	0.052	ppb v/v			12/10/14 23:53	1.48
1,3,5-Trimethylbenzene	ND		0.20	0.065	ppb v/v			12/10/14 23:53	1.48
1,3-Dichlorobenzene	ND		0.20	0.065	ppb v/v			12/10/14 23:53	1.48

HVE 24 Dec 15

TestAmerica Knoxville

# Client Sample Results

Client: Tetra Tech EM Inc.  
Project/Site: West Lake Landfill

TestAmerica Job ID: 140-2440-1

Client Sample ID: WAA-04-SU-PS-20141204

Lab Sample ID: 140-2440-4

Date Collected: 12/04/14 15:20

Matrix: Air

Date Received: 12/09/14 10:15

Sample Container: Summa Canister 6L

## Method: TO-15 - Volatile Organic Compounds in Ambient Air (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,4-Dichlorobenzene	ND		0.20	0.064	ppb v/v			12/10/14 23:53	1.48
Benzene	0.25		0.20	0.056	ppb v/v			12/10/14 23:53	1.48
Benzyl chloride	ND		0.40	0.078	ppb v/v			12/10/14 23:53	1.48
Bromomethane	ND		0.20	0.032	ppb v/v			12/10/14 23:53	1.48
Carbon tetrachloride	0.087	J	0.20	0.038	ppb v/v			12/10/14 23:53	1.48
Chlorobenzene	ND		0.20	0.049	ppb v/v			12/10/14 23:53	1.48
Chloroethane	ND		0.20	0.035	ppb v/v			12/10/14 23:53	1.48
Chloroform	ND		0.20	0.038	ppb v/v			12/10/14 23:53	1.48
Chloromethane	1.0		0.50	0.16	ppb v/v			12/10/14 23:53	1.48
cis-1,2-Dichloroethene	ND		0.20	0.080	ppb v/v			12/10/14 23:53	1.48
cis-1,3-Dichloropropene	ND		0.20	0.074	ppb v/v			12/10/14 23:53	1.48
Dichlorodifluoromethane	0.43		0.20	0.068	ppb v/v			12/10/14 23:53	1.48
Ethylbenzene	ND		0.20	0.068	ppb v/v			12/10/14 23:53	1.48
1,2-Dibromoethane (EDB)	ND		0.20	0.044	ppb v/v			12/10/14 23:53	1.48
Hexachlorobutadiene	ND		1.0	0.078	ppb v/v			12/10/14 23:53	1.48
Methylene Chloride	0.36	J-B u	0.50	0.13	ppb v/v			12/10/14 23:53	1.48
m-Xylene & p-Xylene	ND		0.20	0.12	ppb v/v			12/10/14 23:53	1.48
o-Xylene	0.064	J	0.20	0.061	ppb v/v			12/10/14 23:53	1.48
Styrene	ND		0.20	0.058	ppb v/v			12/10/14 23:53	1.48
Tetrachloroethene	ND		0.20	0.040	ppb v/v			12/10/14 23:53	1.48
Toluene	0.23		0.20	0.12	ppb v/v			12/10/14 23:53	1.48
trans-1,3-Dichloropropene	ND		0.20	0.048	ppb v/v			12/10/14 23:53	1.48
Trichloroethene	ND		0.20	0.036	ppb v/v			12/10/14 23:53	1.48
Trichlorofluoromethane	0.20		0.20	0.024	ppb v/v			12/10/14 23:53	1.48
Vinyl chloride	ND		0.20	0.071	ppb v/v			12/10/14 23:53	1.48

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1,1-Trichloroethane	ND		1.1	0.16	ug/m3			12/10/14 23:53	1.48
1,1,2,2-Tetrachloroethane	ND		1.4	0.42	ug/m3			12/10/14 23:53	1.48
1,1,2-Trichloro-1,2,2-trifluoroethane	0.63	J	1.5	0.24	ug/m3			12/10/14 23:53	1.48
1,1,2-Trichloroethane	ND		1.1	0.29	ug/m3			12/10/14 23:53	1.48
1,1-Dichloroethane	ND		0.81	0.11	ug/m3			12/10/14 23:53	1.48
1,1-Dichloroethene	ND		0.79	0.13	ug/m3			12/10/14 23:53	1.48
1,2,4-Trichlorobenzene	ND		7.4	0.73	ug/m3			12/10/14 23:53	1.48
1,2,4-Trimethylbenzene	ND		0.98	0.31	ug/m3			12/10/14 23:53	1.48
1,2-Dichloro-1,1,2,2-tetrafluoroethane	ND		1.4	0.22	ug/m3			12/10/14 23:53	1.48
1,2-Dichlorobenzene	ND		1.2	0.42	ug/m3			12/10/14 23:53	1.48
1,2-Dichloroethane	0.21	J	0.81	0.19	ug/m3			12/10/14 23:53	1.48
1,2-Dichloropropane	ND		0.92	0.24	ug/m3			12/10/14 23:53	1.48
1,3,5-Trimethylbenzene	ND		0.98	0.32	ug/m3			12/10/14 23:53	1.48
1,3-Dichlorobenzene	ND		1.2	0.39	ug/m3			12/10/14 23:53	1.48
1,4-Dichlorobenzene	ND		1.2	0.38	ug/m3			12/10/14 23:53	1.48
Benzene	0.80		0.84	0.18	ug/m3			12/10/14 23:53	1.48
Benzyl chloride	ND		2.1	0.40	ug/m3			12/10/14 23:53	1.48
Bromomethane	ND		0.78	0.12	ug/m3			12/10/14 23:53	1.48
Carbon tetrachloride	0.54	J	1.3	0.24	ug/m3			12/10/14 23:53	1.48
Chlorobenzene	ND		0.92	0.23	ug/m3			12/10/14 23:53	1.48
Chloroethane	ND		0.63	0.092	ug/m3			12/10/14 23:53	1.48

HUG 24 Feb 15

TestAmerica Knoxville

# Client Sample Results

Client: Tetra Tech EM Inc.  
Project/Site: West Lake Landfill

TestAmerica Job ID: 140-2440-1

Client Sample ID: WAA-04-SU-PS-20141204

Lab Sample ID: 140-2440-4

Date Collected: 12/04/14 15:20

Matrix: Air

Date Received: 12/09/14 10:15

Sample Container: Summa Canister 6L

## Method: TO-15 - Volatile Organic Compounds in Ambient Air (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloroform	ND		0.98	0.19	ug/m3			12/10/14 23:53	1.48
Chloromethane	2.1		1.0	0.33	ug/m3			12/10/14 23:53	1.48
cis-1,2-Dichloroethene	ND		0.79	0.24	ug/m3			12/10/14 23:53	1.48
cis-1,3-Dichloropropene	ND		0.91	0.34	ug/m3			12/10/14 23:53	1.48
Dichlorodifluoromethane	2.1		0.99	0.34	ug/m3			12/10/14 23:53	1.48
Ethylbenzene	ND		0.87	0.30	ug/m3			12/10/14 23:53	1.48
1,2-Dibromoethane (EDB)	ND		1.5	0.34	ug/m3			12/10/14 23:53	1.48
Hexachlorobutadiene	ND		1.1	0.83	ug/m3			12/10/14 23:53	1.48
Methylene Chloride	<del>1.2</del> 1.7	J B u	1.7	0.45	ug/m3			12/10/14 23:53	1.48
m-Xylene & p-Xylene	ND		0.87	0.52	ug/m3			12/10/14 23:53	1.48
o-Xylene	0.28	J	0.87	0.26	ug/m3			12/10/14 23:53	1.48
Styrene	ND		0.85	0.25	ug/m3			12/10/14 23:53	1.48
Tetrachloroethene	ND		1.4	0.27	ug/m3			12/10/14 23:53	1.48
Toluene	0.86		0.75	0.45	ug/m3			12/10/14 23:53	1.48
trans-1,3-Dichloropropene	ND		0.91	0.22	ug/m3			12/10/14 23:53	1.48
Trichloroethene	ND		1.1	0.19	ug/m3			12/10/14 23:53	1.48
Trichlorofluoromethane	1.1		1.1	0.13	ug/m3			12/10/14 23:53	1.48
Vinyl chloride	ND		0.51	0.18	ug/m3			12/10/14 23:53	1.48

Surrogate	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
4-Bromofluorobenzene (Surf)	103		60 - 140		12/10/14 23:53	1.48

Client Sample ID: WAA-05-SU-PS-20141204

Lab Sample ID: 140-2440-5

Date Collected: 12/04/14 14:45

Matrix: Air

Date Received: 12/09/14 10:15

Sample Container: Summa Canister 6L

## Method: TO-15 - Volatile Organic Compounds in Ambient Air

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1,1-Trichloroethane	ND		0.20	0.030	ppb v/v			12/11/14 00:35	1
1,1,2,2-Tetrachloroethane	ND		0.20	0.061	ppb v/v			12/11/14 00:35	1
1,1,2-Trichloro-1,2,2-trifluoroethane	0.087	J	0.20	0.031	ppb v/v			12/11/14 00:35	1
1,1,2-Trichloroethane	ND		0.20	0.054	ppb v/v			12/11/14 00:35	1
1,1-Dichloroethane	ND		0.20	0.026	ppb v/v			12/11/14 00:35	1
1,1-Dichloroethene	ND	*	0.20	0.034	ppb v/v			12/11/14 00:35	1
1,2,4-Trichlorobenzene	ND		1.0	0.098	ppb v/v			12/11/14 00:35	1
1,2,4-Trimethylbenzene	ND		0.20	0.063	ppb v/v			12/11/14 00:35	1
1,2-Dichloro-1,1,2,2-tetrafluoroethane	ND		0.20	0.032	ppb v/v			12/11/14 00:35	1
1,2-Dichlorobenzene	ND		0.20	0.070	ppb v/v			12/11/14 00:35	1
1,2-Dichloroethane	ND		0.20	0.047	ppb v/v			12/11/14 00:35	1
1,2-Dichloropropane	ND		0.20	0.052	ppb v/v			12/11/14 00:35	1
1,3,5-Trimethylbenzene	ND		0.20	0.065	ppb v/v			12/11/14 00:35	1
1,3-Dichlorobenzene	ND		0.20	0.065	ppb v/v			12/11/14 00:35	1
1,4-Dichlorobenzene	ND		0.20	0.064	ppb v/v			12/11/14 00:35	1
Benzene	0.27		0.20	0.056	ppb v/v			12/11/14 00:35	1
Benzyl chloride	ND		0.40	0.078	ppb v/v			12/11/14 00:35	1
Bromomethane	ND		0.20	0.032	ppb v/v			12/11/14 00:35	1
Carbon tetrachloride	0.079	J	0.20	0.032	ppb v/v			12/11/14 00:35	1

AVF 24 Dec 15

TestAmerica Knoxville



# Client Sample Results

Client: Tetra Tech EM Inc.  
Project/Site: West Lake Landfill

TestAmerica Job ID: 140-2440-1

Client Sample ID: WAA-05-SU-PS-20141204

Lab Sample ID: 140-2440-5

Date Collected: 12/04/14 14:45

Matrix: Air

Date Received: 12/09/14 10:15

Sample Container: Summa Canister 6L

## Method: TO-15 - Volatile Organic Compounds in Ambient Air (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chlorobenzene	ND		0.20	0.049	ppb v/v			12/11/14 00:35	1
Chloroethane	ND		0.20	0.035	ppb v/v			12/11/14 00:35	1
Chloroform	ND		0.20	0.038	ppb v/v			12/11/14 00:35	1
Chloromethane	1.1		0.50	0.16	ppb v/v			12/11/14 00:35	1
cis-1,2-Dichloroethene	ND		0.20	0.060	ppb v/v			12/11/14 00:35	1
cis-1,3-Dichloropropene	ND		0.20	0.074	ppb v/v			12/11/14 00:35	1
Dichlorodifluoromethane	0.43		0.20	0.068	ppb v/v			12/11/14 00:35	1
Ethylbenzene	ND		0.20	0.068	ppb v/v			12/11/14 00:35	1
1,2-Dibromoethane (EDB)	ND		0.20	0.044	ppb v/v			12/11/14 00:35	1
Hexachlorobutadiene	ND		1.0	0.078	ppb v/v			12/11/14 00:35	1
Methylene Chloride	0.31 JB	U	0.50	0.13	ppb v/v			12/11/14 00:35	1
m-Xylene & p-Xylene	ND		0.20	0.12	ppb v/v			12/11/14 00:35	1
o-Xylene	ND		0.20	0.061	ppb v/v			12/11/14 00:35	1
Styrene	ND		0.20	0.058	ppb v/v			12/11/14 00:35	1
Tetrachloroethene	ND		0.20	0.040	ppb v/v			12/11/14 00:35	1
Toluene	0.25		0.20	0.12	ppb v/v			12/11/14 00:35	1
trans-1,3-Dichloropropene	ND		0.20	0.048	ppb v/v			12/11/14 00:35	1
Trichloroethene	0.053 J		0.20	0.036	ppb v/v			12/11/14 00:35	1
Trichlorofluoromethane	0.22		0.20	0.024	ppb v/v			12/11/14 00:35	1
Vinyl chloride	ND		0.20	0.071	ppb v/v			12/11/14 00:35	1

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1,1-Trichloroethane	ND		1.1	0.16	ug/m3			12/11/14 00:35	1
1,1,2,2-Tetrachloroethane	ND		1.4	0.42	ug/m3			12/11/14 00:35	1
1,1,2-Trichloro-1,2,2-trifluoroethane	0.67 JS		1.5	0.24	ug/m3			12/11/14 00:35	1
1,1,2-Trichloroethane	ND		1.1	0.29	ug/m3			12/11/14 00:35	1
1,1-Dichloroethane	ND		0.81	0.11	ug/m3			12/11/14 00:35	1
1,1-Dichloroethene	ND		0.79	0.13	ug/m3			12/11/14 00:35	1
1,2,4-Trichlorobenzene	ND		7.4	0.73	ug/m3			12/11/14 00:35	1
1,2,4-Trimethylbenzene	ND		0.98	0.31	ug/m3			12/11/14 00:35	1
1,2-Dichloro-1,1,2,2-tetrafluoroethane	ND		1.4	0.22	ug/m3			12/11/14 00:35	1
1,2-Dichlorobenzene	ND		1.2	0.42	ug/m3			12/11/14 00:35	1
1,2-Dichloroethane	ND		0.81	0.19	ug/m3			12/11/14 00:35	1
1,2-Dichloropropane	ND		0.92	0.24	ug/m3			12/11/14 00:35	1
1,3,5-Trimethylbenzene	ND		0.98	0.32	ug/m3			12/11/14 00:35	1
1,3-Dichlorobenzene	ND		1.2	0.39	ug/m3			12/11/14 00:35	1
1,4-Dichlorobenzene	ND		1.2	0.38	ug/m3			12/11/14 00:35	1
Benzene	0.87		0.84	0.18	ug/m3			12/11/14 00:35	1
Benzyl chloride	ND		2.1	0.40	ug/m3			12/11/14 00:35	1
Bromomethane	ND		0.78	0.12	ug/m3			12/11/14 00:35	1
Carbon tetrachloride	0.50 J		1.3	0.24	ug/m3			12/11/14 00:35	1
Chlorobenzene	ND		0.92	0.23	ug/m3			12/11/14 00:35	1
Chloroethane	ND		0.53	0.092	ug/m3			12/11/14 00:35	1
Chloroform	ND		0.98	0.19	ug/m3			12/11/14 00:35	1
Chloromethane	2.3		1.0	0.33	ug/m3			12/11/14 00:35	1
cis-1,2-Dichloroethene	ND		0.79	0.24	ug/m3			12/11/14 00:35	1
cis-1,3-Dichloropropene	ND		0.91	0.34	ug/m3			12/11/14 00:35	1
Dichlorodifluoromethane	2.1		0.99	0.34	ug/m3			12/11/14 00:35	1

140-2440-5

TestAmerica Knoxville

# Client Sample Results

Client: Tetra Tech EM Inc.  
Project/Site: West Lake Landfill

TestAmerica Job ID: 140-2440-1

Client Sample ID: WAA-05-SU-PS-20141204

Lab Sample ID: 140-2440-5

Date Collected: 12/04/14 14:45

Matrix: Air

Date Received: 12/09/14 10:15

Sample Container: Summa Canister 6L

## Method: TO-15 - Volatile Organic Compounds in Ambient Air (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Ethylbenzene	ND		0.87	0.30	ug/m3			12/11/14 00:35	1
1,2-Dibromoethane (EDB)	ND		1.5	0.34	ug/m3			12/11/14 00:35	1
Hexachlorobutadiene	ND		11	0.83	ug/m3			12/11/14 00:35	1
Methylene Chloride	1.1 JB		1.7	0.45	ug/m3			12/11/14 00:35	1
m-Xylene & p-Xylene	ND		0.87	0.52	ug/m3			12/11/14 00:35	1
o-Xylene	ND		0.87	0.26	ug/m3			12/11/14 00:35	1
Styrene	ND		0.85	0.25	ug/m3			12/11/14 00:35	1
Tetrachloroethene	ND		1.4	0.27	ug/m3			12/11/14 00:35	1
Toluene	0.95		0.75	0.45	ug/m3			12/11/14 00:35	1
trans-1,3-Dichloropropene	ND		0.91	0.22	ug/m3			12/11/14 00:35	1
Trichloroethene	0.29 J		1.1	0.19	ug/m3			12/11/14 00:35	1
Trichlorofluoromethane	1.2		1.1	0.13	ug/m3			12/11/14 00:35	1
Vinyl chloride	ND		0.51	0.18	ug/m3			12/11/14 00:35	1
Surrogate	%Recovery	Qualifier	Limits				Prepared	Analyzed	Dil Fac
4-Bromofluorobenzene (Surr)	98		60 - 140					12/11/14 00:35	1

Client Sample ID: WAA-04-SU-DU-20141204

Lab Sample ID: 140-2440-6

Date Collected: 12/04/14 15:20

Matrix: Air

Date Received: 12/09/14 10:15

Sample Container: Summa Canister 6L

## Method: TO-15 - Volatile Organic Compounds in Ambient Air

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1,1-Trichloroethane	ND		0.20	0.030	ppb v/v			12/11/14 01:17	1
1,1,2,2-Tetrachloroethane	ND		0.20	0.061	ppb v/v			12/11/14 01:17	1
1,1,2-Trichloro-1,2,2-trifluoroethane	0.088 JT		0.20	0.031	ppb v/v			12/11/14 01:17	1
1,1,2-Trichloroethane	ND		0.20	0.054	ppb v/v			12/11/14 01:17	1
1,1-Dichloroethane	ND		0.20	0.026	ppb v/v			12/11/14 01:17	1
1,1-Dichloroethene	ND		0.20	0.034	ppb v/v			12/11/14 01:17	1
1,2,4-Trichlorobenzene	ND		1.0	0.098	ppb v/v			12/11/14 01:17	1
1,2,4-Trimethylbenzene	ND		0.20	0.063	ppb v/v			12/11/14 01:17	1
1,2-Dichloro-1,1,2,2-tetrafluoroethane	ND		0.20	0.032	ppb v/v			12/11/14 01:17	1
1,2-Dichlorobenzene	ND		0.20	0.070	ppb v/v			12/11/14 01:17	1
1,2-Dichloroethane	ND		0.20	0.047	ppb v/v			12/11/14 01:17	1
1,2-Dichloropropane	ND		0.20	0.052	ppb v/v			12/11/14 01:17	1
1,3,5-Trimethylbenzene	ND		0.20	0.065	ppb v/v			12/11/14 01:17	1
1,3-Dichlorobenzene	ND		0.20	0.065	ppb v/v			12/11/14 01:17	1
1,4-Dichlorobenzene	ND		0.20	0.064	ppb v/v			12/11/14 01:17	1
Benzene	0.21		0.20	0.056	ppb v/v			12/11/14 01:17	1
Benzyl chloride	ND		0.40	0.078	ppb v/v			12/11/14 01:17	1
Bromomethane	ND		0.20	0.032	ppb v/v			12/11/14 01:17	1
Carbon tetrachloride	0.065 J		0.20	0.038	ppb v/v			12/11/14 01:17	1
Chlorobenzene	ND		0.20	0.049	ppb v/v			12/11/14 01:17	1
Chloroethane	ND		0.20	0.035	ppb v/v			12/11/14 01:17	1
Chloroform	ND		0.20	0.038	ppb v/v			12/11/14 01:17	1
Chloromethane	1.1		0.50	0.16	ppb v/v			12/11/14 01:17	1
cis-1,2-Dichloroethene	ND		0.20	0.060	ppb v/v			12/11/14 01:17	1

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TestAmerica Knoxville

# Client Sample Results

Client: Tetra Tech EM Inc.  
Project/Site: West Lake Landfill

TestAmerica Job ID: 140-2440-1

Client Sample ID: WAA-04-SU-DU-20141204

Lab Sample ID: 140-2440-6

Date Collected: 12/04/14 15:20

Matrix: Air

Date Received: 12/09/14 10:15

Sample Container: Summa Canister 6L

## Method: TO-15 - Volatile Organic Compounds in Ambient Air (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
cis-1,3-Dichloropropene	ND		0.20	0.074	ppb v/v			12/11/14 01:17	1
Dichlorodifluoromethane	0.52		0.20	0.068	ppb v/v			12/11/14 01:17	1
Ethylbenzene	ND		0.20	0.068	ppb v/v			12/11/14 01:17	1
1,2-Dibromoethane (EDB)	ND		0.20	0.044	ppb v/v			12/11/14 01:17	1
Hexachlorobutadiene	ND		1.0	0.078	ppb v/v			12/11/14 01:17	1
Methylene Chloride	0.35 JB	u	0.50	0.13	ppb v/v			12/11/14 01:17	1
m-Xylene & p-Xylene	ND		0.20	0.12	ppb v/v			12/11/14 01:17	1
o-Xylene	ND		0.20	0.061	ppb v/v			12/11/14 01:17	1
Styrene	ND		0.20	0.058	ppb v/v			12/11/14 01:17	1
Tetrachloroethene	ND		0.20	0.040	ppb v/v			12/11/14 01:17	1
Toluene	0.21		0.20	0.12	ppb v/v			12/11/14 01:17	1
trans-1,3-Dichloropropene	ND		0.20	0.048	ppb v/v			12/11/14 01:17	1
Trichloroethene	ND		0.20	0.036	ppb v/v			12/11/14 01:17	1
Trichlorofluoromethane	0.24		0.20	0.024	ppb v/v			12/11/14 01:17	1
Vinyl chloride	ND		0.20	0.071	ppb v/v			12/11/14 01:17	1

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1,1-Trichloroethane	ND		1.1	0.16	ug/m3			12/11/14 01:17	1
1,1,2,2-Tetrachloroethane	ND		1.4	0.42	ug/m3			12/11/14 01:17	1
1,1,2-Trichloro-1,2,2-trifluoroethane	0.68 JS		1.5	0.24	ug/m3			12/11/14 01:17	1
1,1,2-Trichloroethane	ND		1.1	0.29	ug/m3			12/11/14 01:17	1
1,1-Dichloroethane	ND		0.81	0.11	ug/m3			12/11/14 01:17	1
1,1-Dichloroethene	ND		0.79	0.13	ug/m3			12/11/14 01:17	1
1,2,4-Trichlorobenzene	ND		7.4	0.73	ug/m3			12/11/14 01:17	1
1,2,4-Trimethylbenzene	ND		0.98	0.31	ug/m3			12/11/14 01:17	1
1,2-Dichloro-1,1,2,2-tetrafluoroethane	ND		1.4	0.22	ug/m3			12/11/14 01:17	1
1,2-Dichlorobenzene	ND		1.2	0.42	ug/m3			12/11/14 01:17	1
1,2-Dichloroethane	ND		0.81	0.19	ug/m3			12/11/14 01:17	1
1,2-Dichloropropane	ND		0.92	0.24	ug/m3			12/11/14 01:17	1
1,3,5-Trimethylbenzene	ND		0.98	0.32	ug/m3			12/11/14 01:17	1
1,3-Dichlorobenzene	ND		1.2	0.39	ug/m3			12/11/14 01:17	1
1,4-Dichlorobenzene	ND		1.2	0.38	ug/m3			12/11/14 01:17	1
Benzene	0.66		0.64	0.18	ug/m3			12/11/14 01:17	1
Benzyl chloride	ND		2.1	0.40	ug/m3			12/11/14 01:17	1
Bromomethane	ND		0.78	0.12	ug/m3			12/11/14 01:17	1
Carbon tetrachloride	0.41 J		1.3	0.24	ug/m3			12/11/14 01:17	1
Chlorobenzene	ND		0.92	0.23	ug/m3			12/11/14 01:17	1
Chloroethane	ND		0.53	0.092	ug/m3			12/11/14 01:17	1
Chloroform	ND		0.98	0.19	ug/m3			12/11/14 01:17	1
Chloromethane	2.3		1.0	0.33	ug/m3			12/11/14 01:17	1
cis-1,2-Dichloroethene	ND		0.79	0.24	ug/m3			12/11/14 01:17	1
cis-1,3-Dichloropropene	ND		0.91	0.34	ug/m3			12/11/14 01:17	1
Dichlorodifluoromethane	2.6		0.99	0.34	ug/m3			12/11/14 01:17	1
Ethylbenzene	ND		0.87	0.30	ug/m3			12/11/14 01:17	1
1,2-Dibromoethane (EDB)	ND		1.5	0.34	ug/m3			12/11/14 01:17	1
Hexachlorobutadiene	ND		1.1	0.83	ug/m3			12/11/14 01:17	1
Methylene Chloride	1.2 JB	u	1.7	0.45	ug/m3			12/11/14 01:17	1
m-Xylene & p-Xylene	ND		1.07	0.52	ug/m3			12/11/14 01:17	1

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TestAmerica Knoxville

# Client Sample Results

Client: Tetra Tech EM Inc.  
Project/Site: West Lake Landfill

TestAmerica Job ID: 140-2440-1

Client Sample ID: WAA-04-SU-DU-20141204

Lab Sample ID: 140-2440-6

Date Collected: 12/04/14 15:20

Matrix: Air

Date Received: 12/09/14 10:15

Sample Container: Summa Canister 6L

## Method: TO-15 - Volatile Organic Compounds in Ambient Air (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
o-Xylene	ND		0.87	0.26	ug/m3			12/11/14 01:17	1
Styrene	ND		0.85	0.25	ug/m3			12/11/14 01:17	1
Tetrachloroethene	ND		1.4	0.27	ug/m3			12/11/14 01:17	1
Toluene	0.79		0.75	0.45	ug/m3			12/11/14 01:17	1
trans-1,3-Dichloropropene	ND		0.91	0.22	ug/m3			12/11/14 01:17	1
Trichloroethene	ND		1.1	0.19	ug/m3			12/11/14 01:17	1
Trichlorofluoromethane	1.4		1.1	0.13	ug/m3			12/11/14 01:17	1
Vinyl chloride	ND		0.51	0.18	ug/m3			12/11/14 01:17	1
Surrogate	%Recovery	Qualifier	Limits				Prepared	Analyzed	Dil Fac
4-Bromofluorobenzene (Surr)	100		60 - 140					12/11/14 01:17	1

Client Sample ID: WAA-00-SU-TB-20141204

Lab Sample ID: 140-2440-7

Date Collected: 12/04/14 16:45

Matrix: Air

Date Received: 12/09/14 10:15

Sample Container: Summa Canister 6L

## Method: TO-15 - Volatile Organic Compounds in Ambient Air

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1,1-Trichloroethane	ND		0.20	0.030	ppb v/v			12/11/14 02:01	1
1,1,2,2-Tetrachloroethane	ND		0.20	0.061	ppb v/v			12/11/14 02:01	1
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		0.20	0.031	ppb v/v			12/11/14 02:01	1
1,1,2-Trichloroethane	ND		0.20	0.054	ppb v/v			12/11/14 02:01	1
1,1-Dichloroethane	ND		0.20	0.026	ppb v/v			12/11/14 02:01	1
1,1-Dichloroethene	ND		0.20	0.034	ppb v/v			12/11/14 02:01	1
1,2,4-Trichlorobenzene	ND		1.0	0.098	ppb v/v			12/11/14 02:01	1
1,2,4-Trimethylbenzene	ND		0.20	0.063	ppb v/v			12/11/14 02:01	1
1,2-Dichloro-1,1,2,2-tetrafluoroethane	ND		0.20	0.032	ppb v/v			12/11/14 02:01	1
1,2-Dichlorobenzene	ND		0.20	0.070	ppb v/v			12/11/14 02:01	1
1,2-Dichloroethane	ND		0.20	0.047	ppb v/v			12/11/14 02:01	1
1,2-Dichloropropane	ND		0.20	0.052	ppb v/v			12/11/14 02:01	1
1,3,5-Trimethylbenzene	ND		0.20	0.085	ppb v/v			12/11/14 02:01	1
1,3-Dichlorobenzene	ND		0.20	0.065	ppb v/v			12/11/14 02:01	1
1,4-Dichlorobenzene	ND		0.20	0.064	ppb v/v			12/11/14 02:01	1
Benzene	ND		0.20	0.056	ppb v/v			12/11/14 02:01	1
Benzyl chloride	ND		0.40	0.078	ppb v/v			12/11/14 02:01	1
Bromomethane	ND		0.20	0.032	ppb v/v			12/11/14 02:01	1
Carbon tetrachloride	ND		0.20	0.038	ppb v/v			12/11/14 02:01	1
Chlorobenzene	ND		0.20	0.049	ppb v/v			12/11/14 02:01	1
Chloroethane	ND		0.20	0.035	ppb v/v			12/11/14 02:01	1
Chloroform	ND		0.20	0.038	ppb v/v			12/11/14 02:01	1
Chloromethane	ND		0.50	0.16	ppb v/v			12/11/14 02:01	1
cis-1,2-Dichloroethene	ND		0.20	0.060	ppb v/v			12/11/14 02:01	1
cis-1,3-Dichloropropene	ND		0.20	0.074	ppb v/v			12/11/14 02:01	1
Dichlorodifluoromethane	ND		0.20	0.088	ppb v/v			12/11/14 02:01	1
Ethylbenzene	ND		0.20	0.068	ppb v/v			12/11/14 02:01	1
1,2-Dibromoethane (EDB)	ND		0.20	0.044	ppb v/v			12/11/14 02:01	1
Hexachlorobutadiene	ND		1.0	0.078	ppb v/v			12/11/14 02:01	1
Methylene Chloride	0.25 - JB u		0.50	0.13	ppb v/v			12/11/14 02:01	1

HUF 24 Feb 15

TestAmerica Knoxville



# Client Sample Results

Client: Tetra Tech EM Inc.  
Project/Site: West Lake Landfill

TestAmerica Job ID: 140-2440-1

Client Sample ID: WAA-00-SU-TB-20141204

Lab Sample ID: 140-2440-7

Date Collected: 12/04/14 16:45

Matrix: Air

Date Received: 12/09/14 10:15

Sample Container: Summa Canister 6L

## Method: TO-15 - Volatile Organic Compounds in Ambient Air (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
m-Xylene & p-Xylene	ND		0.20	0.12	ppb v/v			12/11/14 02:01	1
o-Xylene	ND		0.20	0.061	ppb v/v			12/11/14 02:01	1
Styrene	ND		0.20	0.058	ppb v/v			12/11/14 02:01	1
Tetrachloroethene	ND		0.20	0.040	ppb v/v			12/11/14 02:01	1
Toluene	ND		0.20	0.12	ppb v/v			12/11/14 02:01	1
trans-1,3-Dichloropropene	ND		0.20	0.048	ppb v/v			12/11/14 02:01	1
Trichloroethene	ND		0.20	0.036	ppb v/v			12/11/14 02:01	1
Trichlorofluoromethane	ND		0.20	0.024	ppb v/v			12/11/14 02:01	1
Vinyl chloride	ND		0.20	0.071	ppb v/v			12/11/14 02:01	1
Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1,1-Trichloroethane	ND		1.1	0.16	ug/m3			12/11/14 02:01	1
1,1,2,2-Tetrachloroethane	ND		1.4	0.42	ug/m3			12/11/14 02:01	1
1,1,2-Trichloro-1,2,2-trifluoroethane	ND	*	1.5	0.24	ug/m3			12/11/14 02:01	1
1,1,2-Trichloroethane	ND		1.1	0.29	ug/m3			12/11/14 02:01	1
1,1-Dichloroethane	ND		0.81	0.11	ug/m3			12/11/14 02:01	1
1,1-Dichloroethene	ND	*	0.79	0.13	ug/m3			12/11/14 02:01	1
1,2,4-Trichlorobenzene	ND		7.4	0.73	ug/m3			12/11/14 02:01	1
1,2,4-Trimethylbenzene	ND		0.98	0.31	ug/m3			12/11/14 02:01	1
1,2-Dichloro-1,1,2,2-tetrafluoroethane	ND		1.4	0.22	ug/m3			12/11/14 02:01	1
1,2-Dichlorobenzene	ND		1.2	0.42	ug/m3			12/11/14 02:01	1
1,2-Dichloroethane	ND		0.81	0.19	ug/m3			12/11/14 02:01	1
1,2-Dichloropropane	ND		0.92	0.24	ug/m3			12/11/14 02:01	1
1,3,5-Trimethylbenzene	ND		0.98	0.32	ug/m3			12/11/14 02:01	1
1,3-Dichlorobenzene	ND		1.2	0.39	ug/m3			12/11/14 02:01	1
1,4-Dichlorobenzene	ND		1.2	0.38	ug/m3			12/11/14 02:01	1
Benzene	ND		0.64	0.18	ug/m3			12/11/14 02:01	1
Benzyl chloride	ND		2.1	0.40	ug/m3			12/11/14 02:01	1
Bromomethane	ND		0.78	0.12	ug/m3			12/11/14 02:01	1
Carbon tetrachloride	ND		1.3	0.24	ug/m3			12/11/14 02:01	1
Chlorobenzene	ND		0.92	0.23	ug/m3			12/11/14 02:01	1
Chloroethane	ND		0.53	0.092	ug/m3			12/11/14 02:01	1
Chloroform	ND		0.98	0.19	ug/m3			12/11/14 02:01	1
Chloromethane	ND		1.0	0.33	ug/m3			12/11/14 02:01	1
cis-1,2-Dichloroethene	ND		0.79	0.24	ug/m3			12/11/14 02:01	1
cis-1,3-Dichloropropene	ND		0.91	0.34	ug/m3			12/11/14 02:01	1
Dichlorodifluoromethane	ND		0.99	0.34	ug/m3			12/11/14 02:01	1
Ethylbenzene	ND		0.87	0.30	ug/m3			12/11/14 02:01	1
1,2-Dibromoethane (EDB)	ND		1.5	0.34	ug/m3			12/11/14 02:01	1
Hexachlorobutadiene	ND		1.1	0.83	ug/m3			12/11/14 02:01	1
Methylene Chloride	0.85	1.8	1.7	0.45	ug/m3			12/11/14 02:01	1
m-Xylene & p-Xylene	ND		0.87	0.52	ug/m3			12/11/14 02:01	1
o-Xylene	ND		0.87	0.26	ug/m3			12/11/14 02:01	1
Styrene	ND		0.85	0.25	ug/m3			12/11/14 02:01	1
Tetrachloroethane	ND		1.4	0.27	ug/m3			12/11/14 02:01	1
Toluene	ND		0.75	0.45	ug/m3			12/11/14 02:01	1
trans-1,3-Dichloropropene	ND		0.91	0.22	ug/m3			12/11/14 02:01	1
Trichloroethene	ND		1.1	0.19	ug/m3			12/11/14 02:01	1
Trichlorofluoromethane	ND		1.1	0.13	ug/m3			12/11/14 02:01	1

HW 24 Feb 15

TestAmerica Knoxville

## Client Sample Results

Client: Tetra Tech EM Inc.  
Project/Site: West Lake Landfill

TestAmerica Job ID: 140-2440-1

Client Sample ID: WAA-00-SU-TB-20141204

Lab Sample ID: 140-2440-7

Date Collected: 12/04/14 16:45

Matrix: Air

Date Received: 12/09/14 10:15

Sample Container: Summa Canister 6L

### Method: TO-15 - Volatile Organic Compounds in Ambient Air (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Vinyl chloride	ND		0.51	0.18	ug/m3			12/11/14 02:01	1

Surrogate	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
4-Bromofluorobenzene (Sum)	107		60 - 140		12/11/14 02:01	1

AVE  
24 Feb 15

## Surrogate Summary

Client: Tetra Tech EM Inc.  
Project/Site: West Lake Landfill

TestAmerica Job ID: 140-2440-1

### Method: TO-15 - Volatile Organic Compounds in Ambient Air

Matrix: Air

Prep Type: Total/NA

#### Percent Surrogate Recovery (Acceptance Limits)

Lab Sample ID	Client Sample ID	BFB (60-140)
140-2440-1	WAA-01-SU-PS-20141204	100
140-2440-2	WAA-02-SU-PS-20141204	102
140-2440-3	WAA-03-SU-PS-20141204	102
140-2440-4	WAA-04-SU-PS-20141204	103
140-2440-5	WAA-05-SU-PS-20141204	98
140-2440-6	WAA-04-SU-DU-20141204	100
140-2440-7	WAA-00-SU-TB-20141204	107
LCS 140-2031/1002	Lab Control Sample	106
MB 140-2031/4	Method Blank	103

#### Surrogate Legend

BFB = 4-Bromofluorobenzene (Surr)

# QC Sample Results

Client: Tetra Tech EM Inc.  
Project/Site: West Lake Landfill

TestAmerica Job ID: 140-2440-1

## Method: TO-15 - Volatile Organic Compounds in Ambient Air

Lab Sample ID: MB 140-2031/4

Matrix: Air

Analysis Batch: 2031

Client Sample ID: Method Blank

Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1,1-Trichloroethane	ND		0.20	0.030	ppb v/v			12/10/14 16:06	1
1,1,2,2-Tetrachloroethane	ND		0.20	0.061	ppb v/v			12/10/14 16:06	1
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		0.20	0.031	ppb v/v			12/10/14 16:06	1
1,1,2-Trichloroethane	ND		0.20	0.054	ppb v/v			12/10/14 16:06	1
1,1-Dichloroethane	ND		0.20	0.026	ppb v/v			12/10/14 16:06	1
1,1-Dichloroethene	ND		0.20	0.034	ppb v/v			12/10/14 16:06	1
1,2,4-Trichlorobenzene	ND		1.0	0.098	ppb v/v			12/10/14 16:06	1
1,2,4-Trimethylbenzene	ND		0.20	0.063	ppb v/v			12/10/14 16:06	1
1,2-Dichloro-1,1,2,2-tetrafluoroethane	ND		0.20	0.032	ppb v/v			12/10/14 16:06	1
1,2-Dichlorobenzene	ND		0.20	0.070	ppb v/v			12/10/14 16:06	1
1,2-Dichloroethane	ND		0.20	0.047	ppb v/v			12/10/14 16:06	1
1,2-Dichloropropane	ND		0.20	0.052	ppb v/v			12/10/14 16:06	1
1,3,5-Trimethylbenzene	ND		0.20	0.065	ppb v/v			12/10/14 16:06	1
1,3-Dichlorobenzene	ND		0.20	0.065	ppb v/v			12/10/14 16:06	1
1,4-Dichlorobenzene	ND		0.20	0.064	ppb v/v			12/10/14 16:06	1
Benzene	ND		0.20	0.056	ppb v/v			12/10/14 16:06	1
Benzyl chloride	ND		0.40	0.078	ppb v/v			12/10/14 16:06	1
Bromomethane	ND		0.20	0.032	ppb v/v			12/10/14 16:06	1
Carbon tetrachloride	ND		0.20	0.038	ppb v/v			12/10/14 16:06	1
Chlorobenzene	ND		0.20	0.049	ppb v/v			12/10/14 16:06	1
Chloroethane	ND		0.20	0.035	ppb v/v			12/10/14 16:06	1
Chloroform	ND		0.20	0.038	ppb v/v			12/10/14 16:06	1
Chloromethane	ND		0.50	0.16	ppb v/v			12/10/14 16:06	1
cis-1,2-Dichloroethene	ND		0.20	0.060	ppb v/v			12/10/14 16:06	1
cis-1,3-Dichloropropene	ND		0.20	0.074	ppb v/v			12/10/14 16:06	1
Dichlorodifluoromethane	ND		0.20	0.068	ppb v/v			12/10/14 16:06	1
Ethylbenzene	ND		0.20	0.068	ppb v/v			12/10/14 16:06	1
1,2-Dibromoethane (EDB)	ND		0.20	0.044	ppb v/v			12/10/14 16:06	1
Hexachlorobutadiene	ND		1.0	0.078	ppb v/v			12/10/14 16:06	1
Methylene Chloride	0.251	J	0.50	0.13	ppb v/v			12/10/14 16:06	1
m-Xylene & p-Xylene	ND		0.20	0.12	ppb v/v			12/10/14 16:06	1
o-Xylene	ND		0.20	0.061	ppb v/v			12/10/14 16:06	1
Styrene	ND		0.20	0.058	ppb v/v			12/10/14 16:06	1
Tetrachloroethene	ND		0.20	0.040	ppb v/v			12/10/14 16:06	1
Toluene	ND		0.20	0.12	ppb v/v			12/10/14 16:06	1
trans-1,3-Dichloropropene	ND		0.20	0.048	ppb v/v			12/10/14 16:06	1
Trichloroethene	ND		0.20	0.036	ppb v/v			12/10/14 16:06	1
Trichlorofluoromethane	ND		0.20	0.024	ppb v/v			12/10/14 16:06	1
Vinyl chloride	ND		0.20	0.071	ppb v/v			12/10/14 16:06	1

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1,1-Trichloroethane	ND		1.1	0.16	ug/m3			12/10/14 16:06	1
1,1,2,2-Tetrachloroethane	ND		1.4	0.42	ug/m3			12/10/14 16:06	1
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		1.5	0.24	ug/m3			12/10/14 16:06	1
1,1,2-Trichloroethane	ND		1.1	0.29	ug/m3			12/10/14 16:06	1
1,1-Dichloroethane	ND		0.81	0.11	ug/m3			12/10/14 16:06	1
1,1-Dichloroethene	ND		0.79	0.13	ug/m3			12/10/14 16:06	1
1,2,4-Trichlorobenzene	ND		7.4	0.73	ug/m3			12/10/14 16:06	1

TestAmerica Knoxville



# QC Sample Results

Client: Tetra Tech EM Inc.  
Project/Site: West Lake Landfill

TestAmerica Job ID: 140-2440-1

## Method: TO-15 - Volatile Organic Compounds in Ambient Air (Continued)

Lab Sample ID: MB 140-2031/4

Matrix: Air

Analysis Batch: 2031

Client Sample ID: Method Blank

Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,2,4-Trimethylbenzene	ND		0.98	0.31	ug/m3			12/10/14 16:06	1
1,2-Dichloro-1,1,2,2-tetrafluoroethane	ND		1.4	0.22	ug/m3			12/10/14 16:06	1
1,2-Dichlorobenzene	ND		1.2	0.42	ug/m3			12/10/14 16:06	1
1,2-Dichloroethane	ND		0.81	0.19	ug/m3			12/10/14 16:06	1
1,2-Dichloropropane	ND		0.92	0.24	ug/m3			12/10/14 16:06	1
1,3,5-Trimethylbenzene	ND		0.98	0.32	ug/m3			12/10/14 16:06	1
1,3-Dichlorobenzene	ND		1.2	0.39	ug/m3			12/10/14 16:06	1
1,4-Dichlorobenzene	ND		1.2	0.38	ug/m3			12/10/14 16:06	1
Benzene	ND		0.64	0.18	ug/m3			12/10/14 16:06	1
Benzyl chloride	ND		2.1	0.40	ug/m3			12/10/14 16:06	1
Bromomethane	ND		0.78	0.12	ug/m3			12/10/14 16:06	1
Carbon tetrachloride	ND		1.3	0.24	ug/m3			12/10/14 16:06	1
Chlorobenzene	ND		0.92	0.23	ug/m3			12/10/14 16:06	1
Chloroethane	ND		0.53	0.092	ug/m3			12/10/14 16:06	1
Chloroform	ND		0.98	0.19	ug/m3			12/10/14 16:06	1
Chloromethane	ND		1.0	0.33	ug/m3			12/10/14 16:06	1
cis-1,2-Dichloroethene	ND		0.79	0.24	ug/m3			12/10/14 16:06	1
cis-1,3-Dichloropropene	ND		0.91	0.34	ug/m3			12/10/14 16:06	1
Dichlorodifluoromethane	ND		0.99	0.34	ug/m3			12/10/14 16:06	1
Ethylbenzene	ND		0.87	0.30	ug/m3			12/10/14 16:06	1
1,2-Dibromoethane (EDB)	ND		1.5	0.34	ug/m3			12/10/14 16:06	1
Hexachlorobutadiene	ND		11	0.83	ug/m3			12/10/14 16:06	1
Methylene Chloride	0.870	J	1.7	0.45	ug/m3			12/10/14 16:06	1
m-Xylene & p-Xylene	ND		0.87	0.52	ug/m3			12/10/14 16:06	1
o-Xylene	ND		0.87	0.26	ug/m3			12/10/14 16:06	1
Styrene	ND		0.85	0.25	ug/m3			12/10/14 16:06	1
Tetrachloroethene	ND		1.4	0.27	ug/m3			12/10/14 16:06	1
Toluene	ND		0.75	0.45	ug/m3			12/10/14 16:06	1
trans-1,3-Dichloropropene	ND		0.91	0.22	ug/m3			12/10/14 16:06	1
Trichloroethene	ND		1.1	0.19	ug/m3			12/10/14 16:06	1
Trichlorofluoromethane	ND		1.1	0.13	ug/m3			12/10/14 16:06	1
Vinyl chloride	ND		0.51	0.18	ug/m3			12/10/14 16:06	1

Surrogate	MB %Recovery	MB Qualifier	Limits	Prepared	Analyzed	Dil Fac
4-Bromofluorobenzene (Surr)	103		60 - 140		12/10/14 16:06	1

Lab Sample ID: LCS 140-2031/1002

Matrix: Air

Analysis Batch: 2031

Client Sample ID: Lab Control Sample

Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
1,1,1-Trichloroethane	2.00	2.16		ppb v/v		108	70 - 130
1,1,2,2-Tetrachloroethane	2.00	2.60		ppb v/v		130	70 - 130
1,1,2-Trichloro-1,2,2-trifluoroethane	2.00	2.63	*	ppb v/v		131	70 - 130
1,1,2-Trichloroethane	2.00	2.31		ppb v/v		115	70 - 130
1,1-Dichloroethane	2.00	2.40		ppb v/v		120	70 - 130
1,1-Dichloroethene	2.00	2.66	*	ppb v/v		133	70 - 130

TestAmerica Knoxville

# QC Sample Results

Client: Tetra Tech EM Inc.  
Project/Site: West Lake Landfill

TestAmerica Job ID: 140-2440-1

## Method: TO-15 - Volatile Organic Compounds in Ambient Air (Continued)

Lab Sample ID: LCS 140-2031/1002

Matrix: Air

Analysis Batch: 2031

Client Sample ID: Lab Control Sample

Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
1,2,4-Trichlorobenzene	2.00	1.51		ppb v/v		75	60 - 140
1,2,4-Trimethylbenzene	2.00	2.27		ppb v/v		113	70 - 130
1,2-Dichloro-1,1,2,2-tetrafluoroethane	2.00	2.05		ppb v/v		102	60 - 140
1,2-Dichlorobenzene	2.00	1.92		ppb v/v		96	70 - 130
1,2-Dichloroethane	2.00	2.18		ppb v/v		109	70 - 130
1,2-Dichloropropane	2.00	2.45		ppb v/v		123	70 - 130
1,3,5-Trimethylbenzene	2.00	2.27		ppb v/v		114	70 - 130
1,3-Dichlorobenzene	2.00	1.98		ppb v/v		99	70 - 130
1,4-Dichlorobenzene	2.00	1.99		ppb v/v		99	70 - 130
Benzene	2.00	2.43		ppb v/v		121	70 - 130
Benzyl chloride	2.00	2.16		ppb v/v		108	70 - 130
Bromomethane	2.00	2.03		ppb v/v		101	70 - 130
Carbon tetrachloride	2.00	2.48		ppb v/v		124	70 - 130
Chlorobenzene	2.00	2.04		ppb v/v		102	70 - 130
Chloroethane	2.00	2.29		ppb v/v		115	70 - 130
Chloroform	2.00	2.23		ppb v/v		112	70 - 130
Chloromethane	2.00	2.74		ppb v/v		137	60 - 140
cis-1,2-Dichloroethene	2.00	2.41		ppb v/v		120	70 - 130
cis-1,3-Dichloropropene	2.00	2.20		ppb v/v		110	70 - 130
Dichlorodifluoromethane	2.00	2.26		ppb v/v		113	60 - 140
Ethylbenzene	2.00	2.24		ppb v/v		112	70 - 130
1,2-Dibromoethane (EDB)	2.00	2.24		ppb v/v		112	70 - 130
Hexachlorobutadiene	2.00	2.30		ppb v/v		115	60 - 140
Methylene Chloride	2.00	2.57		ppb v/v		129	70 - 130
m-Xylene & p-Xylene	4.00	4.35		ppb v/v		109	70 - 130
o-Xylene	2.00	2.24		ppb v/v		112	70 - 130
Styrene	2.00	2.32		ppb v/v		116	70 - 130
Tetrachloroethene	2.00	2.08		ppb v/v		104	70 - 130
Toluene	2.00	2.36		ppb v/v		118	70 - 130
trans-1,3-Dichloropropene	2.00	2.14		ppb v/v		107	70 - 130
Trichloroethene	2.00	2.09		ppb v/v		105	70 - 130
Trichlorofluoromethane	2.00	2.28		ppb v/v		114	60 - 140
Vinyl chloride	2.00	2.56		ppb v/v		128	70 - 130
Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
1,1,1-Trichloroethane	11	11.8		ug/m3		108	70 - 130
1,1,2,2-Tetrachloroethane	14	17.9		ug/m3		130	70 - 130
1,1,2-Trichloro-1,1,2,2-trifluoroethane	15	20.2	*	ug/m3		131	70 - 130
1,1,2-Trichloroethane	11	12.6		ug/m3		115	70 - 130
1,1-Dichloroethane	8.1	9.70		ug/m3		120	70 - 130
1,1-Dichloroethene	7.9	10.6	*	ug/m3		133	70 - 130
1,2,4-Trichlorobenzene	15	11.2		ug/m3		75	60 - 140
1,2,4-Trimethylbenzene	9.8	11.2		ug/m3		113	70 - 130
1,2-Dichloro-1,1,2,2-tetrafluoroethane	14	14.3		ug/m3		102	60 - 140
1,2-Dichlorobenzene	12	11.5		ug/m3		96	70 - 130
1,2-Dichloroethane	8.1	8.83		ug/m3		109	70 - 130

TestAmerica Knoxville

# QC Sample Results

Client: Tetra Tech EM Inc.  
Project/Site: West Lake Landfill

TestAmerica Job ID: 140-2440-1

## Method: TO-15 - Volatile Organic Compounds in Ambient Air (Continued)

Lab Sample ID: LCS 140-2031/1002

Matrix: Air

Analysis Batch: 2031

Client Sample ID: Lab Control Sample

Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
1,2-Dichloropropane	9.2	11.3		ug/m3		123	70 - 130
1,3,5-Trimethylbenzene	9.8	11.2		ug/m3		114	70 - 130
1,3-Dichlorobenzene	12	11.9		ug/m3		99	70 - 130
1,4-Dichlorobenzene	12	11.9		ug/m3		99	70 - 130
Benzene	6.4	7.76		ug/m3		121	70 - 130
Benzyl chloride	10	11.2		ug/m3		108	70 - 130
Bromomethane	7.8	7.88		ug/m3		101	70 - 130
Carbon tetrachloride	13	15.6		ug/m3		124	70 - 130
Chlorobenzene	9.2	9.41		ug/m3		102	70 - 130
Chloroethane	5.3	6.05		ug/m3		115	70 - 130
Chloroform	9.8	10.9		ug/m3		112	70 - 130
Chloromethane	4.1	5.67		ug/m3		137	60 - 140
cis-1,2-Dichloroethene	7.9	9.55		ug/m3		120	70 - 130
cis-1,3-Dichloropropene	9.1	9.96		ug/m3		110	70 - 130
Dichlorodifluoromethane	9.9	11.2		ug/m3		113	60 - 140
Ethylbenzene	8.7	9.73		ug/m3		112	70 - 130
1,2-Dibromoethane (EDB)	15	17.2		ug/m3		112	70 - 130
Hexachlorobutadiene	21	24.6		ug/m3		115	60 - 140
Methylene Chloride	7.0	8.94		ug/m3		129	70 - 130
m-Xylene & p-Xylene	17	18.9		ug/m3		109	70 - 130
o-Xylene	8.7	9.73		ug/m3		112	70 - 130
Styrene	8.5	9.87		ug/m3		116	70 - 130
Tetrachloroethene	14	14.1		ug/m3		104	70 - 130
Toluene	7.5	8.89		ug/m3		118	70 - 130
trans-1,3-Dichloropropene	9.1	9.71		ug/m3		107	70 - 130
Trichloroethene	11	11.3		ug/m3		105	70 - 130
Trichlorofluoromethane	11	12.8		ug/m3		114	60 - 140
Vinyl chloride	5.1	6.54		ug/m3		128	70 - 130

Surrogate	LCS %Recovery	LCS Qualifier	Limits
4-Bromofluorobenzene (Surr)	106		60 - 140

## QC Association Summary

Client: Tetra Tech EM Inc.  
Project/Site: West Lake Landfill

TestAmerica Job ID: 140-2440-1

### Air - GC/MS VOA

#### Analysis Batch: 2031

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
140-2440-1	WAA-01-SU-PS-20141204	Total/NA	Air	TO-15	
140-2440-2	WAA-02-SU-PS-20141204	Total/NA	Air	TO-15	
140-2440-3	WAA-03-SU-PS-20141204	Total/NA	Air	TO-15	
140-2440-4	WAA-04-SU-PS-20141204	Total/NA	Air	TO-15	
140-2440-5	WAA-05-SU-PS-20141204	Total/NA	Air	TO-15	
140-2440-6	WAA-04-SU-DU-20141204	Total/NA	Air	TO-15	
140-2440-7	WAA-00-SU-TB-20141204	Total/NA	Air	TO-15	
LCS 140-2031/1002	Lab Control Sample	Total/NA	Air	TO-15	
MB 140-2031/4	Method Blank	Total/NA	Air	TO-15	

# Lab Chronicle

Client: Tetra Tech EM Inc.  
Project/Site: West Lake Landfill

TestAmerica Job ID: 140-2440-1

**Client Sample ID: WAA-01-SU-PS-20141204**

**Lab Sample ID: 140-2440-1**

Date Collected: 12/04/14 15:46

Matrix: Air

Date Received: 12/09/14 10:15

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	TO-15		1	200 mL	500 mL	2031	12/10/14 21:01	HMT	TAL KNX
Instrument ID: MG										

**Client Sample ID: WAA-02-SU-PS-20141204**

**Lab Sample ID: 140-2440-2**

Date Collected: 12/04/14 14:27

Matrix: Air

Date Received: 12/09/14 10:15

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	TO-15		1	200 mL	500 mL	2031	12/10/14 22:26	HMT	TAL KNX
Instrument ID: MG										

**Client Sample ID: WAA-03-SU-PS-20141204**

**Lab Sample ID: 140-2440-3**

Date Collected: 12/04/14 15:02

Matrix: Air

Date Received: 12/09/14 10:15

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	TO-15		1	200 mL	500 mL	2031	12/10/14 23:09	HMT	TAL KNX
Instrument ID: MG										

**Client Sample ID: WAA-04-SU-PS-20141204**

**Lab Sample ID: 140-2440-4**

Date Collected: 12/04/14 15:20

Matrix: Air

Date Received: 12/09/14 10:15

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	TO-15		1.48	296 mL	500 mL	2031	12/10/14 23:53	HMT	TAL KNX
Instrument ID: MG										

**Client Sample ID: WAA-05-SU-PS-20141204**

**Lab Sample ID: 140-2440-5**

Date Collected: 12/04/14 14:45

Matrix: Air

Date Received: 12/09/14 10:15

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	TO-15		1	200 mL	500 mL	2031	12/11/14 00:35	HMT	TAL KNX
Instrument ID: MG										

**Client Sample ID: WAA-04-SU-DU-20141204**

**Lab Sample ID: 140-2440-6**

Date Collected: 12/04/14 15:20

Matrix: Air

Date Received: 12/09/14 10:15

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	TO-15		1	200 mL	500 mL	2031	12/11/14 01:17	HMT	TAL KNX
Instrument ID: MG										

TestAmerica Knoxville

Lab Chronicle

Client: Tetra Tech EM Inc.  
Project/Site: West Lake Landfill

TestAmerica Job ID: 140-2440-1

Client Sample ID: WAA-00-SU-TB-20141204  
Date Collected: 12/04/14 16:45  
Date Received: 12/09/14 10:15

Lab Sample ID: 140-2440-7  
Matrix: Air

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	TO-15		1	200 mL	500 mL	2031	12/11/14 02:01	HMT	TAL KNX
Instrument ID: MG										

Laboratory References:  
TAL KNX = TestAmerica Knoxville, 5815 Middlebrook Pike, Knoxville, TN 37921, TEL (865)291-3000

# Certification Summary

Client: Tetra Tech EM Inc.  
Project/Site: West Lake Landfill

TestAmerica Job ID: 140-2440-1

## Laboratory: TestAmerica Knoxville

All certifications held by this laboratory are listed. Not all certifications are applicable to this report.

Authority	Program	EPA Region	Certification ID	Expiration Date
	AFCEE		N/A	
Arkansas DEQ	State Program	6	88-0688	06-17-15
California	State Program	9	2423	06-30-16
Colorado	State Program	8	N/A	02-28-15
Connecticut	State Program	1	PH-0223	09-30-15
Florida	NELAP	4	E87177	06-30-15
Georgia	State Program	4	906	04-13-17
Hawaii	State Program	9	N/A	04-13-15
Kansas	NELAP	7	E-10349	01-31-15
Kentucky (DW)	State Program	4	90101	12-31-14
L-A-B	DoD ELAP		L2311	02-13-16
Louisiana	NELAP	6	LA110001	12-31-15
Maryland	State Program	3	277	03-31-15
Michigan	State Program	5	9933	04-13-17
Nevada	State Program	9	TN00009	07-31-15
New Jersey	NELAP	2	TN001	06-30-15
New York	NELAP	2	10781	03-31-15
North Carolina (DW)	State Program	4	21705	07-31-15
Ohio VAP	State Program	5	CL0059	03-26-15
Oklahoma	State Program	6	9415	08-31-15
Pennsylvania	NELAP	3	68-00576	12-31-14
South Carolina	State Program	4	84001	06-30-15
Tennessee	State Program	4	2014	04-13-17
Texas	NELAP	6	T104704380-TX	08-31-15
USDA	Federal		P330-13-00260	08-29-16
Utah	NELAP	8	QUAN3	07-31-15
Virginia	NELAP	3	460176	09-14-15
Virginia	State Program	3	165	06-30-15
Washington	State Program	10	C593	01-19-15
West Virginia (DW)	State Program	3	9955C	12-31-14
West Virginia DEP	State Program	3	345	04-30-15
Wisconsin	State Program	5	998044300	08-31-15

## Method Summary

Client: Tetra Tech EM Inc.  
Project/Site: West Lake Landfill

TestAmerica Job ID: 140-2440-1

Method	Method Description	Protocol	Laboratory
TO-15	Volatile Organic Compounds in Ambient Air	EPA	TAL KNX

### Protocol References:

EPA = US Environmental Protection Agency

### Laboratory References:

TAL KNX = TestAmerica Knoxville, 5815 Middlebrook Pike, Knoxville, TN 37921, TEL (865)291-3000



## Sample Summary

Client: Tetra Tech EM Inc.  
Project/Site: West Lake Landfill

TestAmerica Job ID: 140-2440-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
140-2440-1	WAA-01-SU-PS-20141204	Air	12/04/14 15:46	12/09/14 10:15
140-2440-2	WAA-02-SU-PS-20141204	Air	12/04/14 14:27	12/09/14 10:15
140-2440-3	WAA-03-SU-PS-20141204	Air	12/04/14 15:02	12/09/14 10:15
140-2440-4	WAA-04-SU-PS-20141204	Air	12/04/14 15:20	12/09/14 10:15
140-2440-5	WAA-05-SU-PS-20141204	Air	12/04/14 14:45	12/09/14 10:15
140-2440-6	WAA-04-SU-DU-20141204	Air	12/04/14 15:20	12/09/14 10:15
140-2440-7	WAA-00-SU-TB-20141204	Air	12/04/14 16:45	12/09/14 10:15

## 5815 Middlebrook Pike

Knoxville, TN 37921  
phone 865.291.3000 fax 865.584.4315

TestAmerica Laboratories, Inc. assumes no liability with respect to the collection and shipment of these samples.

**TestAmerica**  
THE LEADER IN ENVIRONMENTAL TESTING

**TestAmerica Laboratories, Inc.**

[illegible]

Form No. CA-C-WI-003, Rev. 1.1, dated 05/14/2013

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12/17/2014

## Login Sample Receipt Checklist

Client: Tetra Tech EM Inc.

Job Number: 140-2440-1

**Login Number: 2440**

**List Source: TestAmerica Knoxville**

**List Number: 1**

**Creator: Dameron, Bryan K**

Question	Answer	Comment
Radioactivity wasn't checked or is $\leq$ background as measured by a survey meter.	N/A	
The cooler's custody seal, if present, is intact.	N/A	
Sample custody seals, if present, are intact.	N/A	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	N/A	
Cooler Temperature is acceptable.	N/A	
Cooler Temperature is recorded.	N/A	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	True	
There are no discrepancies between the containers received and the COC.	True	
Samples are received within Holding Time.	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	N/A	CHECKED IN LAB
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	N/A	
Sample Preservation Verified.	N/A	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	N/A	
Containers requiring zero headspace have no headspace or bubble is $<6\text{mm}$ (1/4").	N/A	
Multiphasic samples are not present.	N/A	
Samples do not require splitting or compositing.	N/A	
Residual Chlorine Checked.	N/A	

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**Tetra Tech, Inc.**  
**DATA VALIDATION REPORT**  
**LEVEL II**

Site: West Lake Landfill Site, Bridgeton, Missouri

Laboratory: TestAmerica Laboratories, Inc. (Earth City, Missouri)

Data Reviewer: Harry Ellis, Tetra Tech, Inc. (Tetra Tech)

Review Date: February 25, 2015

Sample Delivery Group (SDG): J9958

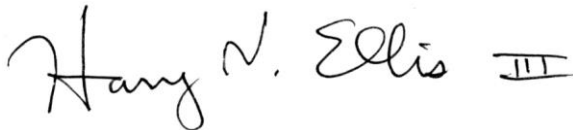
Sample Numbers: WAA-01-AF-PS-20141217, WAA-02-AF-PS-20141217, WAA-03-AF-PS-20141217, WAA-04-AF-PS-20141217, WAA-05-AF-PS-20141217, and WAA-00-AF-FB-20141217

Matrix / Number of Samples: 5 Air Samples and 1 Field Blank

The data were qualified according to the U.S. Environmental Protection Agency (EPA) Region 7 documents entitled "Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review" (9240.1-48), June 2008. In addition, the Tetra Tech document "Review of Data Packages from Subcontracted Laboratories" (February 2002) and the EPA and others document "Multi-Agency Radiological Laboratory Analytical Protocols Manual" (July 2004) were used along with other criteria specified in the applicable methods.

The review was intended to identify problems and quality control (QC) deficiencies that were readily apparent from the summary data package. The following sections discuss any problems or deficiencies that were found, and data qualifications applied because of non-compliant QC. The data review was limited to the available field and laboratory QC information submitted with the project-specific data package.

I, Harry Ellis, certify that all data validation criteria outlined in the above-referenced documents were assessed, and any qualifications made to the data accorded with those documents.



25 February 2015

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Certified by Harry Ellis, Chemist

---

Date

## DATA VALIDATION QUALIFIERS

- U** — The analyte was not detected above the reported sample quantitation limit.
- J** — The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.
- UJ** — The analyte was not detected above the reported sample quantitation limit, which is estimated.
- R** — The sample results are rejected due to serious deficiencies in the ability to analyze the sample and meet QC criteria. Presence or absence of the analyte cannot be verified.

## **DATA ASSESSMENT**

Sample delivery group (SDG) J9958 included five (5) environmental air (filter) samples and one (1) QC sample (a field blank). Samples were analyzed for total alpha-emitting radium by EPA SW-846 Method 9315 and for isotopic (alpha-emitting) thorium and uranium by Department of Energy (DOE) Method A-01-R. The following summarizes the data validation that was performed.

### **RADIOANALYTICAL ANALYSES**

#### **I. Holding Time and Chain of Custody (COC) Requirements**

The samples were received by the laboratory and analyzed within the established holding time of 6 months from sample collection to analysis. No data were qualified.

#### **II. Matrix Spike/Matrix Spike Duplicate (MS/MSD)**

Insufficient sample was available for MS/MSD analyses. Duplicate LCS analysis provided adequate data on precision and accuracy. No qualifications were applied.

#### **III. Blanks**

The laboratory (method) blank and the field yielded low activities for one (of three) thorium isotopes and for one (of three) uranium isotopes. No qualifications were applied.

#### **IV. Laboratory Control Sample (LCS)**

All percent recoveries and relative percent differences from the duplicate LCS analyses were within established control limits.

#### **V. Surrogates**

These radioanalytical methods use a “carrier” or “tracer”, whose recovery serves the same functions as surrogate recoveries. All carrier and tracer recoveries were within the laboratory’s QC limits. No qualifications were applied.

#### **VI. Comments**

All detected results were less than their reporting limits (“RL”). These extrapolations should be qualified as estimated (flagged “J”). In two samples, the actual minimum detectable activity for total radium was greater than the reporting limit, due to the small sample size.

#### **VII. Overall Assessment of Data**

Overall data quality is acceptable, with few qualifications applied. All data are usable as qualified for their intended purposes.

# TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

## ANALYTICAL REPORT

TestAmerica Laboratories, Inc.

TestAmerica St. Louis  
13715 Rider Trail North  
Earth City, MO 63045  
Tel: (314)298-8566

TestAmerica Job ID: 160-9958-1

Client Project/Site: West Lake Landfill - Filters

For:

Tetra Tech EM Inc.  
415 Oak Street  
Kansas City, Missouri 64106

Attn: Ms. Emily Fisher



Authorized for release by:  
1/20/2015 10:38:28 AM

Erika Gish, Project Manager II  
(314)298-8566  
[erika.gish@testamericainc.com](mailto:erika.gish@testamericainc.com)

### LINKS

Review your project  
results through

TotalAccess

Have a Question?



Visit us at:

[www.testamericainc.com](http://www.testamericainc.com)

*This report has been electronically signed and authorized by the signatory. Electronic signature is intended to be the legally binding equivalent of a traditionally handwritten signature.*

*Results relate only to the items tested and the sample(s) as received by the laboratory.*

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## Case Narrative

Client: Tetra Tech EM Inc.  
Project/Site: West Lake Landfill - Filters

TestAmerica Job ID: 160-9958-1

**Job ID: 160-9958-1**

**Laboratory: TestAmerica St. Louis**

### Narrative

## CASE NARRATIVE

**Client: Tetra Tech EM Inc.**

**Project: West Lake Landfill - Filters**

**Report Number: 160-9958-1**

With the exceptions noted as flags or footnotes, standard analytical protocols were followed in the analysis of the samples and no problems were encountered or anomalies observed. In addition all laboratory quality control samples were within established control limits, with any exceptions noted below. Each sample was analyzed to achieve the lowest possible reporting limit within the constraints of the method. In some cases, due to interference or analytes present at high concentrations, samples were diluted. For diluted samples, the reporting limits are adjusted relative to the dilution required.

TestAmerica St. Louis attests to the validity of the laboratory data generated by TestAmerica facilities reported herein. All analyses performed by TestAmerica facilities were done using established laboratory SOPs that incorporate QA/QC procedures described in the application methods. TestAmerica's operations groups have reviewed the data for compliance with the laboratory QA/QC plan, and data have been found to be compliant with laboratory protocols unless otherwise noted below.

The test results in this report meet all NELAP requirements for parameters for which accreditation is required or available. Any exceptions to NELAP requirements are noted in this report. Pursuant to NELAP, this report may not be reproduced, except in full, without the written approval of the laboratory.

Calculations are performed before rounding to avoid round-off errors in calculated results.

All holding times were met and proper preservation noted for the methods performed on these samples, unless otherwise detailed in the individual sections below.

All solid sample results for Chemistry analyses are reported on an "as received" basis unless otherwise indicated by the presence of a % solids value in the method header. All soil/sediment sample results for radiochemistry analyses are based upon sample as dried and disaggregated with the exception of tritium, carbon-14, and iodine-129 by gamma spectroscopy unless requested as wet weight by the client."

This laboratory report is confidential and is intended for the sole use of TestAmerica and its client.

### RECEIPT

The samples were received on 12/22/2014 11:40 AM; the samples arrived in good condition, properly preserved. The temperature of the cooler at receipt was 20.0° C.

### TOTAL ALPHA RADIUM (GFPC)

Samples WAA-01-AF-PS-20141217 (160-9958-1), WAA-02-AF-PS-20141217 (160-9958-2), WAA-03-AF-PS-20141217 (160-9958-3), WAA-04-AF-PS-20141217 (160-9958-4), WAA-05-AF-PS-20141217 (160-9958-5) and WAA-00-AF-FB-20141217 (160-9958-6) were analyzed for Total Alpha Radium (GFPC) in accordance with SW- 846 Method 9315. The samples were prepared on 01/06/2015 and analyzed on 01/07/2015.

Insufficient sample volume was available to perform a matrix spike/matrix spike duplicate/sample duplicate (MS/MSD/DUP). The samples are filters that must be split between multiple analysis. A LCS/LCSD was used instead of a sample duplicate.

The total alpha emitting radium isotopes detection goal was not met for the following samples due to the reduced sample volume; the samples are filters that were split among other analyses: WAA-04-AF-PS-20141217 (160-9958-4), WAA-05-AF-PS-20141217

## Case Narrative

Client: Tetra Tech EM Inc.  
Project/Site: West Lake Landfill - Filters

TestAmerica Job ID: 160-9958-1

### Job ID: 160-9958-1 (Continued)

#### Laboratory: TestAmerica St. Louis (Continued)

(160-9958-5). The data have been qualified and reported.

No additional analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

#### ISOTOPIC THORIUM (ALPHA SPECTROMETRY)

Samples WAA-01-AF-PS-20141217 (160-9958-1), WAA-02-AF-PS-20141217 (160-9958-2), WAA-03-AF-PS-20141217 (160-9958-3), WAA-04-AF-PS-20141217 (160-9958-4), WAA-05-AF-PS-20141217 (160-9958-5) and WAA-00-AF-FB-20141217 (160-9958-6) were analyzed for Isotopic Thorium (Alpha Spectrometry) in accordance with A-01-R. The samples were prepared on 01/05/2015 and analyzed on 01/09/2015.

Insufficient sample volume was available to perform a matrix spike/matrix spike duplicate/sample duplicate (MS/MSD/DUP). The samples are filters that must be split between multiple analysis. A LCS/LCSD was used instead of a sample duplicate.

No additional analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

#### ISOTOPIC URANIUM (ALPHA SPECTROMETRY)

Samples WAA-01-AF-PS-20141217 (160-9958-1), WAA-02-AF-PS-20141217 (160-9958-2), WAA-03-AF-PS-20141217 (160-9958-3), WAA-04-AF-PS-20141217 (160-9958-4), WAA-05-AF-PS-20141217 (160-9958-5) and WAA-00-AF-FB-20141217 (160-9958-6) were analyzed for Isotopic Uranium (Alpha Spectrometry) in accordance with A-01-R. The samples were prepared on 01/05/2015 and analyzed on 01/08/2015.

Insufficient sample volume was available to perform a matrix spike/matrix spike duplicate/sample duplicate (MS/MSD/DUP). The samples are filters that must be split between multiple analysis. A LCS/LCSD was used instead of a sample duplicate.

No additional analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

## Chain of Custody Record

**TestAmerica Laboratories, Inc.**

Regulatory Program: ☐ DW ☐ NPDES ☐ RCRA ☐ Other:[illegible]

## Login Sample Receipt Checklist

Client: Tetra Tech EM Inc.

Job Number: 160-9958-1

Login Number: 9958

List Source: TestAmerica St. Louis

List Number: 1

Creator: Clarke, Jill C

Question	Answer	Comment
Radioactivity wasn't checked or is $\leq$ background as measured by a survey meter.	True	
The cooler's custody seal, if present, is intact.	N/A	
Sample custody seals, if present, are intact.	True	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	N/A	
Cooler Temperature is acceptable.	True	
Cooler Temperature is recorded.	True	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	N/A	
There are no discrepancies between the containers received and the COC.	True	
Samples are received within Holding Time.	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified.	True	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
Containers requiring zero headspace have no headspace or bubble is $<6\text{mm}$ (1/4").	N/A	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Residual Chlorine Checked.	N/A	

## Definitions/Glossary

Client: Tetra Tech EM Inc.  
Project/Site: West Lake Landfill - Filters

TestAmerica Job ID: 160-9958-1

### Qualifiers

#### Rad

Qualifier	Qualifier Description
U	Result is less than the sample detection limit.
G	The Sample MDC is greater than the requested RL.

### Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
α	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
CFL	Contains Free Liquid
CNF	Contains no Free Liquid
DER	Duplicate error ratio (normalized absolute difference)
Dil Fac	Dilution Factor
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision level concentration
MDA	Minimum detectable activity
EDL	Estimated Detection Limit
MDC	Minimum detectable concentration
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
NC	Not Calculated
ND	Not detected at the reporting limit (or MDL or EDL if shown)
PQL	Practical Quantitation Limit
QC	Quality Control
RER	Relative error ratio
RL	Reporting Limit or Requested Limit (Radiochemistry)
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)

## Method Summary

Client: Tetra Tech EM Inc.  
Project/Site: West Lake Landfill - Filters

TestAmerica Job ID: 160-9958-1

Method	Method Description	Protocol	Laboratory
9315	Total Alpha Radium (GFPC)	SW846	TAL SL
A-01-R	Isotopic Thorium (Alpha Spectrometry)	DOE	TAL SL
A-01-R	Isotopic Uranium (Alpha Spectrometry)	DOE	TAL SL

### Protocol References:

DOE = U.S. Department of Energy

SW846 = "Test Methods For Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 And Its Updates.

### Laboratory References:

TAL SL = TestAmerica St. Louis, 13715 Rider Trail North, Earth City, MO 63045, TEL (314)298-8566

## Sample Summary

Client: Tetra Tech EM Inc.

TestAmerica Job ID: 160-9958-1

Project/Site: West Lake Landfill - Filters

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
160-9958-1	WAA-01-AF-PS-20141217	Filter	12/17/14 15:10	12/22/14 11:40
160-9958-2	WAA-02-AF-PS-20141217	Filter	12/17/14 15:18	12/22/14 11:40
160-9958-3	WAA-03-AF-PS-20141217	Filter	12/17/14 15:53	12/22/14 11:40
160-9958-4	WAA-04-AF-PS-20141217	Filter	12/17/14 16:09	12/22/14 11:40
160-9958-5	WAA-05-AF-PS-20141217	Filter	12/17/14 15:40	12/22/14 11:40
160-9958-6	WAA-00-AF-FB-20141217	Filter	12/17/14 00:00	12/22/14 11:40



# Client Sample Results

Client: Tetra Tech EM Inc.  
Project/Site: West Lake Landfill - Filters

TestAmerica Job ID: 160-9958-1

Client Sample ID: WAA-01-AF-PS-20141217

Lab Sample ID: 160-9958-1

Date Collected: 12/17/14 15:10

Matrix: Filter

Date Received: 12/22/14 11:40

## Method: 9315 - Total Alpha Radium (GFPC)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Total Alpha Radium	0.0356	U	0.533	0.533	1.00	1.00	pCi/Sample	01/06/15 13:24	01/07/15 20:21	1
Carrier	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Ba Carrier	96.8		40 - 110					01/06/15 13:24	01/07/15 20:21	1

## Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.120	U	0.106	0.107	1.00	0.168	pCi/Sample	01/05/15 13:13	01/09/15 11:36	1
Thorium-230	0.464	J	0.125	0.131	1.00	0.0759	pCi/Sample	01/05/15 13:13	01/09/15 11:36	1
Thorium-232	0.0237	U	0.0417	0.0418	1.00	0.0756	pCi/Sample	01/05/15 13:13	01/09/15 11:36	1
Tracer	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Thorium-229	93.1		30 - 110					01/05/15 13:13	01/09/15 11:36	1

## Method: A-01-R - Isotopic Uranium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Uranium-233/234	0.0909	J	0.0525	0.0531	1.00	0.0227	pCi/Sample	01/05/15 13:13	01/08/15 12:35	1
Uranium-235/236	0.0189	U	0.0462	0.0462	1.00	0.0903	pCi/Sample	01/05/15 13:13	01/08/15 12:35	1
Uranium-238	0.0983	J	0.0545	0.0552	1.00	0.0227	pCi/Sample	01/05/15 13:13	01/08/15 12:35	1
Tracer	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Uranium-232	94.4		30 - 110					01/05/15 13:13	01/08/15 12:35	1

Client Sample ID: WAA-02-AF-PS-20141217

Lab Sample ID: 160-9958-2

Date Collected: 12/17/14 15:18

Matrix: Filter

Date Received: 12/22/14 11:40

## Method: 9315 - Total Alpha Radium (GFPC)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Total Alpha Radium	0.0544	U	0.474	0.474	1.00	0.899	pCi/Sample	01/06/15 13:24	01/07/15 20:22	1
Carrier	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Ba Carrier	97.6		40 - 110					01/06/15 13:24	01/07/15 20:22	1

## Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.167	J	0.112	0.113	1.00	0.164	pCi/Sample	01/05/15 13:13	01/09/15 11:36	1
Thorium-230	0.322	J	0.109	0.112	1.00	0.0888	pCi/Sample	01/05/15 13:13	01/09/15 11:36	1
Thorium-232	0.0685	U	0.0628	0.0631	1.00	0.0928	pCi/Sample	01/05/15 13:13	01/09/15 11:36	1

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TestAmerica St. Louis

# Client Sample Results

Client: Tetra Tech EM Inc.  
Project/Site: West Lake Landfill - Filters

TestAmerica Job ID: 160-9958-1

Client Sample ID: WAA-02-AF-PS-20141217

Lab Sample ID: 160-9958-2

Date Collected: 12/17/14 15:18

Matrix: Filter

Date Received: 12/22/14 11:40

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	91.0		30 - 110	01/05/15 13:13	01/09/15 11:36	1

Method: A-01-R - Isotopic Uranium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Uranium-233/234	0.0450	U	0.0519	0.0521	1.00	0.0829	pCi/Sample	01/05/15 13:13	01/08/15 12:35	1
Uranium-235/236	0.00933	U	0.0323	0.0323	1.00	0.0714	pCi/Sample	01/05/15 13:13	01/08/15 12:35	1
Uranium-238	0.0823	J	0.0540	0.0544	1.00	0.0573	pCi/Sample	01/05/15 13:13	01/08/15 12:35	1

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Uranium-232	93.5		30 - 110	01/05/15 13:13	01/08/15 12:35	1

Client Sample ID: WAA-03-AF-PS-20141217

Lab Sample ID: 160-9958-3

Date Collected: 12/17/14 15:53

Matrix: Filter

Date Received: 12/22/14 11:40

Method: 9315 - Total Alpha Radium (GFPC)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Total Alpha Radium	0.603	U	0.507	0.510	1.00	0.765	pCi/Sample	01/06/15 13:24	01/07/15 20:22	1

Carrier	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Ba Carrier	97.3		40 - 110	01/06/15 13:24	01/07/15 20:22	1

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.0823	U	0.112	0.112	1.00	0.187	pCi/Sample	01/05/15 13:13	01/09/15 11:36	1
Thorium-230	0.263	J	0.101	0.104	1.00	0.0914	pCi/Sample	01/05/15 13:13	01/09/15 11:36	1
Thorium-232	-0.0246	U	0.0634	0.0635	1.00	0.139	pCi/Sample	01/05/15 13:13	01/09/15 11:36	1

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	91.4		30 - 110	01/05/15 13:13	01/09/15 11:36	1

Method: A-01-R - Isotopic Uranium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Uranium-233/234	0.141	J	0.0900	0.0908	1.00	0.125	pCi/Sample	01/05/15 13:13	01/08/15 12:35	1
Uranium-235/236	-0.0184	U	0.0451	0.0451	1.00	0.113	pCi/Sample	01/05/15 13:13	01/08/15 12:35	1
Uranium-238	0.118	J	0.0661	0.0668	1.00	0.0708	pCi/Sample	01/05/15 13:13	01/08/15 12:35	1

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Uranium-232	96.1		30 - 110	01/05/15 13:13	01/08/15 12:35	1

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TestAmerica St. Louis

# Client Sample Results

Client: Tetra Tech EM Inc.  
Project/Site: West Lake Landfill - Filters

TestAmerica Job ID: 160-9958-1

Client Sample ID: WAA-04-AF-PS-20141217

Lab Sample ID: 160-9958-4

Date Collected: 12/17/14 16:09

Matrix: Filter

Date Received: 12/22/14 11:40

## Method: 9315 - Total Alpha Radium (GFPC)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Total Alpha Radium	0.582	UG	0.647	0.649	1.00	1.08	pCi/Sample	01/06/15 13:24	01/07/15 20:22	1
Carrier	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Ba Carrier	100		40 - 110					01/06/15 13:24	01/07/15 20:22	1

## Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.0660	U	0.0921	0.0923	1.00	0.155	pCi/Sample	01/05/15 13:13	01/09/15 11:36	1
Thorium-230	0.502	3	0.122	0.129	1.00	0.0551	pCi/Sample	01/05/15 13:13	01/09/15 11:36	1
Thorium-232	0.0432	3	0.0352	0.0354	1.00	0.0215	pCi/Sample	01/05/15 13:13	01/09/15 11:36	1
Tracer	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Thorium-229	98.9		30 - 110					01/05/15 13:13	01/09/15 11:36	1

## Method: A-01-R - Isotopic Uranium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Uranium-233/234	0.000	U	0.0945	0.0945	1.00	0.178	pCi/Sample	01/05/15 13:13	01/08/15 12:35	1
Uranium-235/236	0.000	U	0.0455	0.0455	1.00	0.103	pCi/Sample	01/05/15 13:13	01/08/15 12:35	1
Uranium-238	0.0373	U	0.0830	0.0831	1.00	0.147	pCi/Sample	01/05/15 13:13	01/08/15 12:35	1
Tracer	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Uranium-232	94.5		30 - 110					01/05/15 13:13	01/08/15 12:35	1

Client Sample ID: WAA-05-AF-PS-20141217

Lab Sample ID: 160-9958-5

Date Collected: 12/17/14 15:40

Matrix: Filter

Date Received: 12/22/14 11:40

## Method: 9315 - Total Alpha Radium (GFPC)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Total Alpha Radium	0.298	UG	0.613	0.614	1.00	1.07	pCi/Sample	01/06/15 13:24	01/07/15 20:22	1
Carrier	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Ba Carrier	98.2		40 - 110					01/06/15 13:24	01/07/15 20:22	1

## Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.0733	U	0.112	0.112	1.00	0.189	pCi/Sample	01/05/15 13:13	01/09/15 11:36	1
Thorium-230	0.350	3	0.112	0.115	1.00	0.0780	pCi/Sample	01/05/15 13:13	01/09/15 11:36	1
Thorium-232	0.0405	U	0.0486	0.0487	1.00	0.0776	pCi/Sample	01/05/15 13:13	01/09/15 11:36	1
Tracer	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Thorium-229	86.5		30 - 110					01/05/15 13:13	01/09/15 11:36	1

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TestAmerica St. Louis



# Client Sample Results

Client: Tetra Tech EM Inc.  
Project/Site: West Lake Landfill - Filters

TestAmerica Job ID: 160-9958-1

Client Sample ID: WAA-05-AF-PS-20141217

Lab Sample ID: 160-9958-5

Date Collected: 12/17/14 15:40

Matrix: Filter

Date Received: 12/22/14 11:40

## Method: A-01-R - Isotopic Uranium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Uranium-233/234	0.116	J	0.0706	0.0712	1.00	0.0873	pCi/Sample	01/05/15 13:13	01/08/15 12:37	1
Uranium-235/236	-0.0196	Y	0.0393	0.0393	1.00	0.109	pCi/Sample	01/05/15 13:13	01/08/15 12:37	1
Uranium-238	0.0630	U	0.0546	0.0548	1.00	0.0754	pCi/Sample	01/05/15 13:13	01/08/15 12:37	1
Tracer	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Uranium-232	92.6		30 - 110					01/05/15 13:13	01/08/15 12:37	1

Client Sample ID: WAA-00-AF-FB-20141217

Lab Sample ID: 160-9958-6

Date Collected: 12/17/14 00:00

Matrix: Filter

Date Received: 12/22/14 11:40

## Method: 9315 - Total Alpha Radium (GFPC)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Total Alpha Radium	0.585	U	0.598	0.601	1.00	0.662	pCi/Sample	01/06/15 13:24	01/07/15 20:32	1
Carrier	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Ba Carrier	102		40 - 110					01/06/15 13:24	01/07/15 20:32	1

## Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.124	U	0.108	0.109	1.00	0.170	pCi/Sample	01/05/15 13:13	01/09/15 11:36	1
Thorium-230	0.363	J	0.107	0.111	1.00	0.0701	pCi/Sample	01/05/15 13:13	01/09/15 11:36	1
Thorium-232	0.0470	U	0.0424	0.0425	1.00	0.0557	pCi/Sample	01/05/15 13:13	01/09/15 11:36	1
Tracer	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Thorium-229	101		30 - 110					01/05/15 13:13	01/09/15 11:36	1

## Method: A-01-R - Isotopic Uranium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Uranium-233/234	0.113	J	0.0759	0.0765	1.00	0.0996	pCi/Sample	01/05/15 13:13	01/08/15 12:37	1
Uranium-235/236	0.0101	Y	0.0349	0.0349	1.00	0.0771	pCi/Sample	01/05/15 13:13	01/08/15 12:37	1
Uranium-238	0.0646	U	0.0646	0.0649	1.00	0.0994	pCi/Sample	01/05/15 13:13	01/08/15 12:37	1
Tracer	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Uranium-232	88.3		30 - 110					01/05/15 13:13	01/08/15 12:37	1

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# QC Sample Results

Client: Tetra Tech EM Inc.  
Project/Site: West Lake Landfill - Filters

TestAmerica Job ID: 160-9958-1

## Method: 9315 - Total Apha Radium (GFPC)

Lab Sample ID: MB 160-166845/1-A

Matrix: Filter

Analysis Batch: 167353

Client Sample ID: Method Blank

Prep Type: Total/NA

Prep Batch: 166845

Analyte	MB Result	MB Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Total Alpha Radium	-0.01820	U	0.509	0.509	1.00	0.979	pCi/Sample	01/06/15 13:24	01/07/15 20:21	1
Carrier	MB %Yield	MB Qualifier	Limits					Prepared	Analyzed	Dil Fac
Ba Carrier	92.0		40 - 110					01/06/15 13:24	01/07/15 20:21	1

Lab Sample ID: LCS 160-166845/2-A

Matrix: Filter

Analysis Batch: 167353

Client Sample ID: Lab Control Sample

Prep Type: Total/NA

Prep Batch: 166845

Analyte	Spike Added	LCS Result	LCS Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits	
Total Alpha Radium	45.0	36.31		4.21	1.00	0.990	pCi/Samp	81	65 - 150	
Carrier	LCS %Yield	LCS Qualifier	Limits							
Ba Carrier	92.3		40 - 110							

Lab Sample ID: LCSD 160-166845/3-A

Matrix: Filter

Analysis Batch: 167353

Client Sample ID: Lab Control Sample Dup

Prep Type: Total/NA

Prep Batch: 166845

Analyte	Spike Added	LCSD Result	LCSD Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits	RER	RER Limit
Total Alpha Radium	45.0	40.65		4.61	1.00	0.857	pCi/Samp	90	65 - 150	0.49	1
Carrier	LCSD %Yield	LCSD Qualifier	Limits								
Ba Carrier	92.3		40 - 110								

## Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Lab Sample ID: MB 160-166622/1-A

Matrix: Filter

Analysis Batch: 167566

Client Sample ID: Method Blank

Prep Type: Total/NA

Prep Batch: 166622

Analyte	MB Result	MB Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.1075	U	0.113	0.114	1.00	0.184	pCi/Sample	01/05/15 13:13	01/09/15 11:36	1
Thorium-230	0.4535		0.133	0.139	1.00	0.111	pCi/Sample	01/05/15 13:13	01/09/15 11:36	1
Thorium-232	0.008919	U	0.0371	0.0371	1.00	0.0789	pCi/Sample	01/05/15 13:13	01/09/15 11:36	1
Tracer	MB %Yield	MB Qualifier	Limits					Prepared	Analyzed	Dil Fac
Thorium-229	86.2		30 - 110					01/05/15 13:13	01/09/15 11:36	1

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# QC Sample Results

Client: Tetra Tech EM Inc.  
Project/Site: West Lake Landfill - Filters

TestAmerica Job ID: 160-9958-1

## Method: A-01-R - Isotopic Thorium (Alpha Spectrometry) (Continued)

Lab Sample ID: LCS 160-166622/2-A

Matrix: Filter

Analysis Batch: 167567

Client Sample ID: Lab Control Sample

Prep Type: Total/NA

Prep Batch: 166622

Analyte	Spike Added	LCS Result	LCS Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits
Thorium-230	16.1	17.07		1.61	1.00	0.0601	pCi/Samp	106	81 - 118
Tracer	LCS %Yield	LCS Qualifier	Limits						
Thorium-229	93.3		30 - 110						

Lab Sample ID: LCSD 160-166622/3-A

Matrix: Filter

Analysis Batch: 167568

Client Sample ID: Lab Control Sample Dup

Prep Type: Total/NA

Prep Batch: 166622

Analyte	Spike Added	LCSD Result	LCSD Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits	RER	RER Limit
Thorium-230	16.1	17.28		1.64	1.00	0.0791	pCi/Samp	108	81 - 118	0.06	1
Tracer	LCSD %Yield	LCSD Qualifier	Limits								
Thorium-229	87.5		30 - 110								

## Method: A-01-R - Isotopic Uranium (Alpha Spectrometry)

Lab Sample ID: MB 160-166623/1-A

Matrix: Filter

Analysis Batch: 167424

Client Sample ID: Method Blank

Prep Type: Total/NA

Prep Batch: 166623

Analyte	MB Result	MB Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Uranium-233/234	0.09569		0.0677	0.0681	1.00	0.0882	pCi/Sample	01/05/15 13:13	01/08/15 12:35	1
Uranium-235/236	0.02977	U	0.0525	0.0526	1.00	0.0951	pCi/Sample	01/05/15 13:13	01/08/15 12:35	1
Uranium-238	0.04775	U	0.0637	0.0638	1.00	0.107	pCi/Sample	01/05/15 13:13	01/08/15 12:35	1
Tracer	MB %Yield	MB Qualifier	Limits			Prepared	Analyzed	Dil Fac		
Uranium-232	87.8		30 - 110			01/05/15 13:13	01/08/15 12:35	1		

Lab Sample ID: LCS 160-166623/2-A

Matrix: Filter

Analysis Batch: 167425

Client Sample ID: Lab Control Sample

Prep Type: Total/NA

Prep Batch: 166623

Analyte	Spike Added	LCS Result	LCS Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits
Uranium-233/234	25.5	24.90		2.28	1.00	0.0902	pCi/Samp	98	84 - 120
Uranium-238	26.0	25.85		2.36	1.00	0.0780	pCi/Samp	99	82 - 122
Tracer	LCS %Yield	LCS Qualifier	Limits						
Uranium-232	89.0		30 - 110						

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# QC Sample Results

Client: Tetra Tech EM Inc.  
Project/Site: West Lake Landfill - Filters

TestAmerica Job ID: 160-9958-1

## Method: A-01-R - Isotopic Uranium (Alpha Spectrometry) (Continued)

Lab Sample ID: LCSD 160-166623/3-A

Matrix: Filter

Analysis Batch: 167426

Client Sample ID: Lab Control Sample Dup

Prep Type: Total/NA

Prep Batch: 166623

Analyte	Spike Added	LCSD Result	LCSD Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits	RER	RER Limit
Uranium-233/234	25.5	25.49		2.33	1.00	0.0248	pCi/Samp	100	84 - 120	0.13	1
Uranium-238	26.0	25.94		2.37	1.00	0.0791	pCi/Samp	100	82 - 122	0.02	1

Tracer	LCSD %Yield	LCSD Qualifier	Limits
Uranium-232	86.8		30 - 110



# QC Association Summary

Client: Tetra Tech EM Inc.  
Project/Site: West Lake Landfill - Filters

TestAmerica Job ID: 160-9958-1

## Rad

### Prep Batch: 166622

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-9958-1	WAA-01-AF-PS-20141217	Total/NA	Filter	ExtChrom	
160-9958-2	WAA-02-AF-PS-20141217	Total/NA	Filter	ExtChrom	
160-9958-3	WAA-03-AF-PS-20141217	Total/NA	Filter	ExtChrom	
160-9958-4	WAA-04-AF-PS-20141217	Total/NA	Filter	ExtChrom	
160-9958-5	WAA-05-AF-PS-20141217	Total/NA	Filter	ExtChrom	
160-9958-6	WAA-00-AF-FB-20141217	Total/NA	Filter	ExtChrom	
LCS 160-166622/2-A	Lab Control Sample	Total/NA	Filter	ExtChrom	
LCSD 160-166622/3-A	Lab Control Sample Dup	Total/NA	Filter	ExtChrom	
MB 160-166622/1-A	Method Blank	Total/NA	Filter	ExtChrom	

### Prep Batch: 166623

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-9958-1	WAA-01-AF-PS-20141217	Total/NA	Filter	ExtChrom	
160-9958-2	WAA-02-AF-PS-20141217	Total/NA	Filter	ExtChrom	
160-9958-3	WAA-03-AF-PS-20141217	Total/NA	Filter	ExtChrom	
160-9958-4	WAA-04-AF-PS-20141217	Total/NA	Filter	ExtChrom	
160-9958-5	WAA-05-AF-PS-20141217	Total/NA	Filter	ExtChrom	
160-9958-6	WAA-00-AF-FB-20141217	Total/NA	Filter	ExtChrom	
LCS 160-166623/2-A	Lab Control Sample	Total/NA	Filter	ExtChrom	
LCSD 160-166623/3-A	Lab Control Sample Dup	Total/NA	Filter	ExtChrom	
MB 160-166623/1-A	Method Blank	Total/NA	Filter	ExtChrom	

### Prep Batch: 166845

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-9958-1	WAA-01-AF-PS-20141217	Total/NA	Filter	DPS-0	
160-9958-2	WAA-02-AF-PS-20141217	Total/NA	Filter	DPS-0	
160-9958-3	WAA-03-AF-PS-20141217	Total/NA	Filter	DPS-0	
160-9958-4	WAA-04-AF-PS-20141217	Total/NA	Filter	DPS-0	
160-9958-5	WAA-05-AF-PS-20141217	Total/NA	Filter	DPS-0	
160-9958-6	WAA-00-AF-FB-20141217	Total/NA	Filter	DPS-0	
LCS 160-166845/2-A	Lab Control Sample	Total/NA	Filter	DPS-0	
LCSD 160-166845/3-A	Lab Control Sample Dup	Total/NA	Filter	DPS-0	
MB 160-166845/1-A	Method Blank	Total/NA	Filter	DPS-0	

## Tracer/Carrier Summary

Client: Tetra Tech EM Inc.  
Project/Site: West Lake Landfill - Filters

TestAmerica Job ID: 160-9958-1

### Method: 9315 - Total Apha Radium (GFPC)

Matrix: Filter

Prep Type: Total/NA

		Percent Yield (Acceptance Limits)					
Lab Sample ID	Client Sample ID	Ba (40-110)					
160-9958-1	WAA-01-AF-PS-20141217	96.8					
160-9958-2	WAA-02-AF-PS-20141217	97.6					
160-9958-3	WAA-03-AF-PS-20141217	97.3					
160-9958-4	WAA-04-AF-PS-20141217	100					
160-9958-5	WAA-05-AF-PS-20141217	98.2					
160-9958-6	WAA-00-AF-FB-20141217	102					
LCS 160-166845/2-A	Lab Control Sample	92.3					
LCSD 160-166845/3-A	Lab Control Sample Dup	92.3					
MB 160-166845/1-A	Method Blank	92.0					
<b>Tracer/Carrier Legend</b>							
Ba = Ba Carrier							

### Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Matrix: Filter

Prep Type: Total/NA

		Percent Yield (Acceptance Limits)					
Lab Sample ID	Client Sample ID	Th-229 (30-110)					
160-9958-1	WAA-01-AF-PS-20141217	93.1					
160-9958-2	WAA-02-AF-PS-20141217	91.0					
160-9958-3	WAA-03-AF-PS-20141217	91.4					
160-9958-4	WAA-04-AF-PS-20141217	98.9					
160-9958-5	WAA-05-AF-PS-20141217	86.5					
160-9958-6	WAA-00-AF-FB-20141217	101					
LCS 160-166622/2-A	Lab Control Sample	93.3					
LCSD 160-166622/3-A	Lab Control Sample Dup	87.5					
MB 160-166622/1-A	Method Blank	86.2					
<b>Tracer/Carrier Legend</b>							
Th-229 = Thorium-229							

### Method: A-01-R - Isotopic Uranium (Alpha Spectrometry)

Matrix: Filter

Prep Type: Total/NA

		Percent Yield (Acceptance Limits)					
Lab Sample ID	Client Sample ID	U-232 (30-110)					
160-9958-1	WAA-01-AF-PS-20141217	94.4					
160-9958-2	WAA-02-AF-PS-20141217	93.5					
160-9958-3	WAA-03-AF-PS-20141217	96.1					
160-9958-4	WAA-04-AF-PS-20141217	94.5					
160-9958-5	WAA-05-AF-PS-20141217	92.6					
160-9958-6	WAA-00-AF-FB-20141217	88.3					
LCS 160-166623/2-A	Lab Control Sample	89.0					
LCSD 160-166623/3-A	Lab Control Sample Dup	86.8					
MB 160-166623/1-A	Method Blank	87.8					
<b>Tracer/Carrier Legend</b>							
U-232 = Uranium-232							

TestAmerica St. Louis

**Tetra Tech, Inc.**  
**DATA VALIDATION REPORT**  
**LEVEL II**

Site: West Lake Landfill Site, Bridgeton, Missouri

Laboratory: TestAmerica Laboratories, Inc. (Earth City, Missouri)

Data Reviewer: Harry Ellis, Tetra Tech, Inc. (Tetra Tech)

Review Date: February 25, 2015

Sample Delivery Group (SDG): J9986

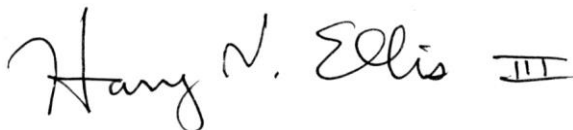
Sample Numbers: WAA-01-AF-PS-20141223, WAA-02-AF-PS-20141223, WAA-03-AF-PS-20141223, WAA-04-AF-PS-20141223, WAA-05-AF-PS-20141223, and WAA-00-AF-FB-20141223

Matrix / Number of Samples: 5 Air Samples and 1 Field Blank

The data were qualified according to the U.S. Environmental Protection Agency (EPA) Region 7 documents entitled "Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review" (9240.1-48), June 2008. In addition, the Tetra Tech document "Review of Data Packages from Subcontracted Laboratories" (February 2002) and the EPA and others document "Multi-Agency Radiological Laboratory Analytical Protocols Manual" (July 2004) were used along with other criteria specified in the applicable methods.

The review was intended to identify problems and quality control (QC) deficiencies that were readily apparent from the summary data package. The following sections discuss any problems or deficiencies that were found, and data qualifications applied because of non-compliant QC. The data review was limited to the available field and laboratory QC information submitted with the project-specific data package.

I, Harry Ellis, certify that all data validation criteria outlined in the above-referenced documents were assessed, and any qualifications made to the data accorded with those documents.



25 February 2015

---

Certified by Harry Ellis, Chemist

---

Date

## DATA VALIDATION QUALIFIERS

- U** — The analyte was not detected above the reported sample quantitation limit.
- J** — The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.
- UJ** — The analyte was not detected above the reported sample quantitation limit, which is estimated.
- R** — The sample results are rejected due to serious deficiencies in the ability to analyze the sample and meet QC criteria. Presence or absence of the analyte cannot be verified.

## **DATA ASSESSMENT**

Sample delivery group (SDG) J9986 included five (5) environmental air (filter) samples and one (1) QC sample (a field blank). Samples were analyzed for total alpha-emitting radium by EPA SW-846 Method 9315 and for isotopic (alpha-emitting) thorium and uranium by Department of Energy (DOE) Method A-01-R. The following summarizes the data validation that was performed.

### **RADIOANALYTICAL ANALYSES**

#### **I. Holding Time and Chain of Custody (COC) Requirements**

The samples were received by the laboratory and analyzed within the established holding time of 6 months from sample collection to analysis. No data were qualified.

#### **II. Matrix Spike/Matrix Spike Duplicate (MS/MSD)**

Insufficient sample was available for MS/MSD analyses. Duplicate LCS analysis provided adequate data on precision and accuracy. No qualifications were applied.

#### **III. Blanks**

The laboratory (method) blank yielded low activities for one (of three) thorium isotopes and for one (of three) uranium isotopes, while the field blank yielded similar activities for those two isotopes and one more uranium isotope. No qualifications were applied.

#### **IV. Laboratory Control Sample (LCS)**

All percent recoveries and relative percent differences from the duplicate LCS analyses were within established control limits.

#### **V. Surrogates**

These radioanalytical methods use a “carrier” or “tracer”, whose recovery serves the same functions as surrogate recoveries. All carrier and tracer recoveries were within the laboratory’s QC limits. No qualifications were applied.

#### **VI. Comments**

All detected results were less than their reporting limits (“RL”). These extrapolations should be qualified as estimated (flagged “J”).

#### **VII. Overall Assessment of Data**

Overall data quality is acceptable, with few qualifications applied. All data are usable as qualified for their intended purposes.

## ANALYTICAL REPORT

TestAmerica Laboratories, Inc.

TestAmerica St. Louis  
13715 Rider Trail North  
Earth City, MO 63045  
Tel: (314)298-8566

TestAmerica Job ID: 160-9986-1

Client Project/Site: West Lake Landfill - Filters

For:

Tetra Tech EM Inc.  
415 Oak Street  
Kansas City, Missouri 64106

Attn: Ms. Emily Fisher

*Rhonda Ridenhower*

Authorized for release by:

1/29/2015 10:29:04 AM

Rhonda Ridenhower, Manager of Project Management  
[rhonda.ridenhower@testamericainc.com](mailto:rhonda.ridenhower@testamericainc.com)

Designee for

Erika Gish, Project Manager II  
(314)298-8566  
[erika.gish@testamericainc.com](mailto:erika.gish@testamericainc.com)

### LINKS

Review your project  
results through

TotalAccess

Have a Question?



Visit us at:

[www.testamericainc.com](http://www.testamericainc.com)

*This report has been electronically signed and authorized by the signatory. Electronic signature is intended to be the legally binding equivalent of a traditionally handwritten signature.*

*Results relate only to the items tested and the sample(s) as received by the laboratory.*



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## Case Narrative

Client: Tetra Tech EM Inc.  
Project/Site: West Lake Landfill - Filters

TestAmerica Job ID: 160-9986-1

**Job ID: 160-9986-1**

**Laboratory: TestAmerica St. Louis**

### Narrative

## CASE NARRATIVE

**Client: Tetra Tech EM Inc.**

**Project: West Lake Landfill - Filters**

**Report Number: 160-9986-1**

With the exceptions noted as flags or footnotes, standard analytical protocols were followed in the analysis of the samples and no problems were encountered or anomalies observed. In addition all laboratory quality control samples were within established control limits, with any exceptions noted below. Each sample was analyzed to achieve the lowest possible reporting limit within the constraints of the method. In some cases, due to interference or analytes present at high concentrations, samples were diluted. For diluted samples, the reporting limits are adjusted relative to the dilution required.

TestAmerica St. Louis attests to the validity of the laboratory data generated by TestAmerica facilities reported herein. All analyses performed by TestAmerica facilities were done using established laboratory SOPs that incorporate QA/QC procedures described in the application methods. TestAmerica's operations groups have reviewed the data for compliance with the laboratory QA/QC plan, and data have been found to be compliant with laboratory protocols unless otherwise noted below.

The test results in this report meet all NELAP requirements for parameters for which accreditation is required or available. Any exceptions to NELAP requirements are noted in this report. Pursuant to NELAP, this report may not be reproduced, except in full, without the written approval of the laboratory.

Calculations are performed before rounding to avoid round-off errors in calculated results.

All holding times were met and proper preservation noted for the methods performed on these samples, unless otherwise detailed in the individual sections below.

All solid sample results for Chemistry analyses are reported on an "as received" basis unless otherwise indicated by the presence of a % solids value in the method header. All soil/sediment sample results for radiochemistry analyses are based upon sample as dried and disaggregated with the exception of tritium, carbon-14, and iodine-129 by gamma spectroscopy unless requested as wet weight by the client."

This laboratory report is confidential and is intended for the sole use of TestAmerica and its client.

### RECEIPT

The samples were received on 12/29/2014; the samples arrived in good condition, properly preserved. The temperature of the coolers at receipt was 20.0 C.

The following samples are filters that were split between multiple analyses: WAA-00-AF-FB-20141223 (160-9986-6), WAA-01-AF-PS-20141223 (160-9986-1), WAA-02-AF-PS-20141223 (160-9986-2), WAA-03-AF-PS-20141223 (160-9986-3), WAA-04-AF-PS-20141223 (160-9986-4), WAA-05-AF-PS-20141223 (160-9986-5). A LCS/LCSD was performed as batch QC

### TOTAL ALPHA RADIUM (GFPC)

Samples WAA-01-AF-PS-20141223 (160-9986-1), WAA-02-AF-PS-20141223 (160-9986-2), WAA-03-AF-PS-20141223 (160-9986-3), WAA-04-AF-PS-20141223 (160-9986-4), WAA-05-AF-PS-20141223 (160-9986-5) and WAA-00-AF-FB-20141223 (160-9986-6) were analyzed for Total Alpha Radium (GFPC) in accordance with SW- 846 Method 9315. The samples were prepared on 01/07/2015 and analyzed on 01/13/2015.

No analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

## Case Narrative

Client: Tetra Tech EM Inc.  
Project/Site: West Lake Landfill - Filters

TestAmerica Job ID: 160-9986-1

### Job ID: 160-9986-1 (Continued)

Laboratory: TestAmerica St. Louis (Continued)

#### ISOTOPIC THORIUM (ALPHA SPECTROMETRY)

Samples WAA-01-AF-PS-20141223 (160-9986-1), WAA-02-AF-PS-20141223 (160-9986-2), WAA-03-AF-PS-20141223 (160-9986-3), WAA-04-AF-PS-20141223 (160-9986-4), WAA-05-AF-PS-20141223 (160-9986-5) and WAA-00-AF-FB-20141223 (160-9986-6) were analyzed for Isotopic Thorium (Alpha Spectrometry) in accordance with A-01-R. The samples were prepared on 01/07/2015 and analyzed on 01/09/2015.

No analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

#### ISOTOPIC URANIUM (ALPHA SPECTROMETRY)

Samples WAA-01-AF-PS-20141223 (160-9986-1), WAA-02-AF-PS-20141223 (160-9986-2), WAA-03-AF-PS-20141223 (160-9986-3), WAA-04-AF-PS-20141223 (160-9986-4), WAA-05-AF-PS-20141223 (160-9986-5) and WAA-00-AF-FB-20141223 (160-9986-6) were analyzed for Isotopic Uranium (Alpha Spectrometry) in accordance with A-01-R. The samples were prepared on 01/07/2015 and analyzed on 01/09/2015.

No analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

## TestAmerica St. Louis

13715 Rider Trail North

Earth City, MO 63045  
phone 314.298.8566 fax


## Chain of Custody Record

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

TestAmerica Laboratories, Inc.

Regulatory Program: ☐ DW ☐ NPDES ☐ RCRA ☐ Other: **29AOK**

<b>Client Contact</b>		<b>Project Manager: Dave Kinroth</b>		<b>Site Contact: Dave Kinroth</b>		<b>Date: 12-26-14</b>		<b>COC No:</b>							
Tetra Tech, Inc.		Tel/Fax: 314-517-6798		Lab Contact: Mike Franks		Carrier: NA		1 of 1 COCs							
415 Oak Street		<b>Analysis Turnaround Time</b>						Sampler:							
Kansas City, MO 64106		<input type="checkbox"/> CALENDAR DAYS <input checked="" type="checkbox"/> WORKING DAYS						<b>For Lab Use Only:</b>							
(816) 412-1786 Phone		TAT if different from Below 20						Walk-in Client:							
(816) 816-410-1748 FAX		<input type="checkbox"/> 2 weeks						Lab Sampling:							
Project Name: West Lake Landfill Site		<input type="checkbox"/> 1 week						Job / SDG No.:							
Site: Bridgeton, MO		<input type="checkbox"/> 2 days													
P O # 1105610		<input type="checkbox"/> 1 day													
<b>Sample Identification</b>		<b>Sample Date</b>	<b>Sample Time</b>	<b>Sample Type (C=Comp, G=Grab)</b>	<b>Matrix</b>	<b># of Cont.</b>	<b>Filtered Sample (Y/N)</b>	<b>Perform MS / MSD (Y/N)</b>	<b>9310 Gross Alpha/Beta</b>	<b>GA-01-R Gamma Spec</b>	<b>9315 Total Alpha Radium</b>	<b>A-01-R Isotopic Thorium</b>	<b>A-01-R Isotopic Uranium</b>	<b>* 9315 Radium-226 (GFPC)</b>	<b>Sample Specific Notes:</b>
WAA-01-AF-PS-20141223	12/23/14	15:38	Filter	Air	1			X	X	X	X	X	X		* 9315 Radium-226 (GFPC)
WAA-02-AF-PS-20141223	12/23/14	14:15	Filter	Air	1			X	X	X	X	X	X		contingent upon TAR results
WAA-03-AF-PS-20141223	12/23/14	14:45	Filter	Air	1			X	X	X	X	X	X		for all samples
WAA-04-AF-PS-20141223	12/23/14	15:02	Filter	Air	1			X	X	X	X	X	X		
WAA-05-AF-PS-20141223	12/23/14	14:27	Filter	Air	1			X	X	X	X	X	X		
WAA-00-AF-FB-20141223	12/23/14	NA	Filter	Air	1			X	X	X	X	X	X		
 160-9986 Chain of Custody															
<b>Preservation Used:</b> 1= Ice, 2= HCl, 3= H2SO4, 4= HNO3, 5= NaOH, 6= Other															
<b>Possible Hazard Identification:</b> Are any samples from a listed EPA Hazardous Waste? Please List any EPA Waste Codes for the sample in the Comments Section if the lab is to dispose of the sample.															
<input checked="" type="checkbox"/> Non-Hazard <input type="checkbox"/> Flammable <input type="checkbox"/> Skin Irritant <input type="checkbox"/> Poison B <input type="checkbox"/> Unknown															
<b>Sample Disposal ( A fee may be assessed if samples are retained longer than 1 month)</b> <input type="checkbox"/> Return to Client <input type="checkbox"/> Disposal by Lab <input type="checkbox"/> Archive for _____ Months															
<b>Special Instructions/QC Requirements &amp; Comments:</b>															
<b>Custody Seals Intact:</b> <input type="checkbox"/> Yes <input type="checkbox"/> No															
<b>Custody Seal No.:</b>															
<b>Cooler Temp. (°C): Obs'd:</b> <b>Corr'd:</b> <b>Therm ID No.:</b>															
Relinquished by: <i>Tiny Barlow</i>		Company: <i>Tetra Tech</i>		Date/Time: <i>12-29-14 11:30</i>		Received by: <i>[Signature]</i>		Company: <i>TSI</i>		Date/Time: <i>12-29-14 / 1130</i>					
Relinquished by:		Company:		Date/Time:		Received by:		Company:		Date/Time:					
Relinquished by:		Company:		Date/Time:		Received in Laboratory by:		Company:		Date/Time:					

## Login Sample Receipt Checklist

Client: Tetra Tech EM Inc.

Job Number: 160-9986-1

Login Number: 9986

List Source: TestAmerica St. Louis

List Number: 1

Creator: Clarke, Jill C

Question	Answer	Comment
Radioactivity wasn't checked or is $\leq$ background as measured by a survey meter.	True	
The cooler's custody seal, if present, is intact.	N/A	
Sample custody seals, if present, are intact.	True	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	N/A	
Cooler Temperature is acceptable.	True	
Cooler Temperature is recorded.	True	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	N/A	
There are no discrepancies between the containers received and the COC.	True	
Samples are received within Holding Time.	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified.	True	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
Containers requiring zero headspace have no headspace or bubble is $<6\text{mm}$ (1/4").	N/A	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Residual Chlorine Checked.	N/A	

## Definitions/Glossary

Client: Tetra Tech EM Inc.  
Project/Site: West Lake Landfill - Filters

TestAmerica Job ID: 160-9986-1

### Qualifiers

#### Rad

Qualifier	Qualifier Description
U	Result is less than the sample detection limit.

### Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
α	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
CFL	Contains Free Liquid
CNF	Contains no Free Liquid
DER	Duplicate error ratio (normalized absolute difference)
Dil Fac	Dilution Factor
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision level concentration
MDA	Minimum detectable activity
EDL	Estimated Detection Limit
MDC	Minimum detectable concentration
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
NC	Not Calculated
ND	Not detected at the reporting limit (or MDL or EDL if shown)
PQL	Practical Quantitation Limit
QC	Quality Control
RER	Relative error ratio
RL	Reporting Limit or Requested Limit (Radiochemistry)
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)

## Method Summary

Client: Tetra Tech EM Inc.  
Project/Site: West Lake Landfill - Filters

TestAmerica Job ID: 160-9986-1

Method	Method Description	Protocol	Laboratory
9315	Total Alpha Radium (GFPC)	SW846	TAL SL
A-01-R	Isotopic Thorium (Alpha Spectrometry)	DOE	TAL SL
A-01-R	Isotopic Uranium (Alpha Spectrometry)	DOE	TAL SL

### Protocol References:

DOE = U.S. Department of Energy

SW846 = "Test Methods For Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 And Its Updates.

### Laboratory References:

TAL SL = TestAmerica St. Louis, 13715 Rider Trail North, Earth City, MO 63045, TEL (314)298-8566

## Sample Summary

Client: Tetra Tech EM Inc.  
Project/Site: West Lake Landfill - Filters

TestAmerica Job ID: 160-9986-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
160-9986-1	WAA-01-AF-PS-20141223	Filter	12/23/14 15:38	12/29/14 11:30
160-9986-2	WAA-02-AF-PS-20141223	Filter	12/23/14 14:15	12/29/14 11:30
160-9986-3	WAA-03-AF-PS-20141223	Filter	12/23/14 14:45	12/29/14 11:30
160-9986-4	WAA-04-AF-PS-20141223	Filter	12/23/14 15:02	12/29/14 11:30
160-9986-5	WAA-05-AF-PS-20141223	Filter	12/23/14 14:27	12/29/14 11:30
160-9986-6	WAA-00-AF-FB-20141223	Filter	12/23/14 00:00	12/29/14 11:30



# Client Sample Results

Client: Tetra Tech EM Inc.  
Project/Site: West Lake Landfill - Filters

TestAmerica Job ID: 160-9986-1

Client Sample ID: WAA-01-AF-PS-20141223

Lab Sample ID: 160-9986-1

Date Collected: 12/23/14 15:38

Matrix: Filter

Date Received: 12/29/14 11:30

## Method: 9315 - Total Alpha Radium (GFPC)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Total Alpha Radium	0.487	3	0.288	0.292	1.00	0.407	pCi/Sample	01/07/15 10:34	01/13/15 22:15	1
Carrier	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Ba Carrier	101		40 - 110					01/07/15 10:34	01/13/15 22:15	1

## Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.0353	4	0.0999	0.100	1.00	0.180	pCi/Sample	01/07/15 08:19	01/09/15 11:39	1
Thorium-230	0.456	3	0.132	0.137	1.00	0.0847	pCi/Sample	01/07/15 08:19	01/09/15 11:39	1
Thorium-232	0.0440	3	0.0393	0.0395	1.00	0.0264	pCi/Sample	01/07/15 08:19	01/09/15 11:39	1
Tracer	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Thorium-229	80.7		30 - 110					01/07/15 08:19	01/09/15 11:39	1

## Method: A-01-R - Isotopic Uranium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Uranium-233/234	0.0698	3	0.0515	0.0518	1.00	0.0594	pCi/Sample	01/07/15 08:19	01/09/15 11:41	1
Uranium-235/236	0.000	4	0.0193	0.0193	1.00	0.0290	pCi/Sample	01/07/15 08:19	01/09/15 11:41	1
Uranium-238	0.0387	3	0.0346	0.0348	1.00	0.0232	pCi/Sample	01/07/15 08:19	01/09/15 11:41	1
Tracer	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Uranium-232	94.8		30 - 110					01/07/15 08:19	01/09/15 11:41	1

Client Sample ID: WAA-02-AF-PS-20141223

Lab Sample ID: 160-9986-2

Date Collected: 12/23/14 14:15

Matrix: Filter

Date Received: 12/29/14 11:30

## Method: 9315 - Total Alpha Radium (GFPC)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Total Alpha Radium	0.0600	4	0.238	0.238	1.00	0.467	pCi/Sample	01/07/15 10:34	01/13/15 22:15	1
Carrier	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Ba Carrier	100		40 - 110					01/07/15 10:34	01/13/15 22:15	1

## Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.154	4	0.129	0.130	1.00	0.202	pCi/Sample	01/07/15 08:19	01/09/15 11:39	1
Thorium-230	0.440	3	0.126	0.131	1.00	0.0896	pCi/Sample	01/07/15 08:19	01/09/15 11:39	1
Thorium-232	0.0846	3	0.0571	0.0576	1.00	0.0619	pCi/Sample	01/07/15 08:19	01/09/15 11:39	1

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TestAmerica St. Louis

# Client Sample Results

Client: Tetra Tech EM Inc.  
Project/Site: West Lake Landfill - Filters

TestAmerica Job ID: 160-9986-1

Client Sample ID: WAA-02-AF-PS-20141223

Lab Sample ID: 160-9986-2

Date Collected: 12/23/14 14:15

Matrix: Filter

Date Received: 12/29/14 11:30

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	91.2		30 - 110	01/07/15 08:19	01/09/15 11:39	1

Method: A-01-R - Isotopic Uranium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Uranium-233/234	0.0757	U	0.0606	0.0609	1.00	0.0838	pCi/Sample	01/07/15 08:19	01/09/15 11:41	1
Uranium-235/236	0.0283	U	0.0326	0.0327	1.00	0.0283	pCi/Sample	01/07/15 08:19	01/09/15 11:41	1
Uranium-238	0.0605	U	0.0478	0.0481	1.00	0.0578	pCi/Sample	01/07/15 08:19	01/09/15 11:41	1

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Uranium-232	95.6		30 - 110	01/07/15 08:19	01/09/15 11:41	1

Client Sample ID: WAA-03-AF-PS-20141223

Lab Sample ID: 160-9986-3

Date Collected: 12/23/14 14:45

Matrix: Filter

Date Received: 12/29/14 11:30

Method: 9315 - Total Alpha Radium (GFPC)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Total Alpha Radium	0.0407	U	0.243	0.243	1.00	0.450	pCi/Sample	01/07/15 10:34	01/13/15 22:15	1

Carrier	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Ba Carrier	100		40 - 110	01/07/15 10:34	01/13/15 22:15	1

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.121	U	0.101	0.101	1.00	0.155	pCi/Sample	01/07/15 08:19	01/09/15 11:39	1
Thorium-230	0.367	U	0.108	0.112	1.00	0.0581	pCi/Sample	01/07/15 08:19	01/09/15 11:39	1
Thorium-232	0.0645	U	0.0491	0.0494	1.00	0.0578	pCi/Sample	01/07/15 08:19	01/09/15 11:39	1

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	96.3		30 - 110	01/07/15 08:19	01/09/15 11:39	1

Method: A-01-R - Isotopic Uranium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Uranium-233/234	0.0634	U	0.0634	0.0636	1.00	0.0975	pCi/Sample	01/07/15 08:19	01/09/15 11:41	1
Uranium-235/236	0.0197	U	0.0279	0.0279	1.00	0.0296	pCi/Sample	01/07/15 08:19	01/09/15 11:41	1
Uranium-238	0.0870	U	0.0570	0.0575	1.00	0.0605	pCi/Sample	01/07/15 08:19	01/09/15 11:41	1

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Uranium-232	87.9		30 - 110	01/07/15 08:19	01/09/15 11:41	1

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TestAmerica St Louis

# Client Sample Results

Client: Tetra Tech EM Inc.  
Project/Site: West Lake Landfill - Filters

TestAmerica Job ID: 160-9986-1

Client Sample ID: WAA-04-AF-PS-20141223

Lab Sample ID: 160-9986-4

Date Collected: 12/23/14 15:02

Matrix: Filter

Date Received: 12/29/14 11:30

## Method: 9315 - Total Alpha Radium (GFPC)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Total Alpha Radium	0.0280	U	0.259	0.259	1.00	0.488	pCi/Sample	01/07/15 10:34	01/13/15 22:15	1
Carrier	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Ba Carrier	104		40 - 110					01/07/15 10:34	01/13/15 22:15	1

## Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.196	J	0.105	0.106	1.00	0.139	pCi/Sample	01/07/15 08:19	01/09/15 11:39	1
Thorium-230	0.307	J	0.103	0.106	1.00	0.0748	pCi/Sample	01/07/15 08:19	01/09/15 11:39	1
Thorium-232	0.0391	J	0.0349	0.0351	1.00	0.0234	pCi/Sample	01/07/15 08:19	01/09/15 11:39	1
Tracer	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Thorium-229	91.4		30 - 110					01/07/15 08:19	01/09/15 11:39	1

## Method: A-01-R - Isotopic Uranium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Uranium-233/234	0.112	J	0.0643	0.0649	1.00	0.0615	pCi/Sample	01/07/15 08:19	01/09/15 11:41	1
Uranium-235/238	0.000	U	0.0283	0.0283	1.00	0.0765	pCi/Sample	01/07/15 08:19	01/09/15 11:41	1
Uranium-238	0.0721	J	0.0481	0.0485	1.00	0.0240	pCi/Sample	01/07/15 08:19	01/09/15 11:41	1
Tracer	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Uranium-232	87.6		30 - 110					01/07/15 08:19	01/09/15 11:41	1

Client Sample ID: WAA-05-AF-PS-20141223

Lab Sample ID: 160-9986-5

Date Collected: 12/23/14 14:27

Matrix: Filter

Date Received: 12/29/14 11:30

## Method: 9315 - Total Alpha Radium (GFPC)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Total Alpha Radium	0.0764	U	0.222	0.222	1.00	0.402	pCi/Sample	01/07/15 10:34	01/13/15 22:15	1
Carrier	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Ba Carrier	102		40 - 110					01/07/15 10:34	01/13/15 22:15	1

## Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.128	U	0.102	0.103	1.00	0.156	pCi/Sample	01/07/15 08:19	01/09/15 11:39	1
Thorium-230	0.317	J	0.0984	0.102	1.00	0.0229	pCi/Sample	01/07/15 08:19	01/09/15 11:39	1
Thorium-232	0.0380	U	0.0402	0.0404	1.00	0.0582	pCi/Sample	01/07/15 08:19	01/09/15 11:39	1
Tracer	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Thorium-229	96.8		30 - 110					01/07/15 08:19	01/09/15 11:39	1

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# Client Sample Results

Client: Tetra Tech EM Inc.  
Project/Site: West Lake Landfill - Filters

TestAmerica Job ID: 160-9986-1

Client Sample ID: WAA-05-AF-PS-20141223

Lab Sample ID: 160-9986-5

Date Collected: 12/23/14 14:27

Matrix: Filter

Date Received: 12/29/14 11:30

## Method: A-01-R - Isotopic Uranium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count	Total	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
			Uncert.	Uncert.						
			(2σ+/-)	(2σ+/-)						
Uranium-233/234	0.0396	U	0.0525	0.0526	1.00	0.0875	pCi/Sample	01/07/15 08:19	01/09/15 11:41	1
Uranium-235/238	0.0197	U	0.0279	0.0279	1.00	0.0295	pCi/Sample	01/07/15 08:19	01/09/15 11:41	1
Uranium-238	0.0711	J	0.0524	0.0527	1.00	0.0805	pCi/Sample	01/07/15 08:19	01/09/15 11:41	1
<hr/>										
Tracer	% Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Uranium-232	92.1		30 - 110					01/07/15 08:19	01/09/15 11:41	1

Client Sample ID: WAA-00-AF-FB-20141223

Lab Sample ID: 160-9986-6

Date Collected: 12/23/14 00:00

Matrix: Filter

Date Received: 12/29/14 11:30

## Method: 9315 - Total Alpha Radium (GFPC)

Analyte	Result	Qualifier	Count	Total	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
			Uncert.	Uncert.						
			(2σ+/-)	(2σ+/-)						
Total Alpha Radium	0.181	U	0.281	0.282	1.00	0.478	pCi/Sample	01/07/15 10:34	01/13/15 22:15	1
<hr/>										
Carrier	% Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Ba Carrier	99.4		40 - 110					01/07/15 10:34	01/13/15 22:15	1

## Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count	Total	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
			Uncert.	Uncert.						
			(2σ+/-)	(2σ+/-)						
Thorium-228	0.120	U	0.108	0.108	1.00	0.169	pCi/Sample	01/07/15 08:19	01/09/15 11:39	1
Thorium-230	0.614	J	0.142	0.151	1.00	0.0614	pCi/Sample	01/07/15 08:19	01/09/15 11:39	1
Thorium-232	0.0319	U	0.0391	0.0392	1.00	0.0611	pCi/Sample	01/07/15 08:19	01/09/15 11:39	1
<hr/>										
Tracer	% Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Thorium-229	92.8		30 - 110					01/07/15 08:19	01/09/15 11:39	1

## Method: A-01-R - Isotopic Uranium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count	Total	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
			Uncert.	Uncert.						
			(2σ+/-)	(2σ+/-)						
Uranium-233/234	0.107	J	0.0573	0.0580	1.00	0.0230	pCi/Sample	01/07/15 08:19	01/09/15 11:41	1
Uranium-235/236	0.000	U	0.0190	0.0190	1.00	0.0286	pCi/Sample	01/07/15 08:19	01/09/15 11:41	1
Uranium-238	0.107	J	0.0511	0.0618	1.00	0.0585	pCi/Sample	01/07/15 08:19	01/09/15 11:41	1
<hr/>										
Tracer	% Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Uranium-232	93.2		30 - 110					01/07/15 08:19	01/09/15 11:41	1

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# QC Sample Results

Client: Tetra Tech EM Inc.  
Project/Site: West Lake Landfill - Filters

TestAmerica Job ID: 160-9986-1

## Method: 9315 - Total Apha Radium (GFPC)

Lab Sample ID: MB 160-167121/1-A

Matrix: Filter

Analysis Batch: 168078

Client Sample ID: Method Blank

Prep Type: Total/NA

Prep Batch: 167121

Analyte	MB Result	MB Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Total Alpha Radium	0.1274	U	0.281	0.281	1.00	0.492	pCi/Sample	01/07/15 10:34	01/13/15 18:50	1
Carrier	MB %Yield	MB Qualifier	Limits					Prepared	Analyzed	Dil Fac
Ba Carrier	96.5		40 - 110					01/07/15 10:34	01/13/15 18:50	1

Lab Sample ID: LCS 160-167121/2-A

Matrix: Filter

Analysis Batch: 168078

Client Sample ID: Lab Control Sample

Prep Type: Total/NA

Prep Batch: 167121

Analyte	Spike Added	LCS Result	LCS Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits		
Total Alpha Radium	45.0	44.95		4.48	1.00	0.484	pCi/Samp	100	65 - 150		
Carrier	LCS %Yield	LCS Qualifier	Limits								
Ba Carrier	95.6		40 - 110								

Lab Sample ID: LCSD 160-167121/3-A

Matrix: Filter

Analysis Batch: 168078

Client Sample ID: Lab Control Sample Dup

Prep Type: Total/NA

Prep Batch: 167121

Analyte	Spike Added	LCSD Result	LCSD Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits	RER	RER Limit
Total Alpha Radium	45.0	46.19		4.59	1.00	0.371	pCi/Samp	103	65 - 150	0.14	1
Carrier	LCSD %Yield	LCSD Qualifier	Limits								
Ba Carrier	95.3		40 - 110								

## Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Lab Sample ID: MB 160-167107/1-A

Matrix: Filter

Analysis Batch: 167575

Client Sample ID: Method Blank

Prep Type: Total/NA

Prep Batch: 167107

Analyte	MB Result	MB Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.1261	U	0.0995	0.100	1.00	0.151	pCi/Sample	01/07/15 08:19	01/09/15 11:39	1
Thorium-230	0.1988		0.0851	0.0867	1.00	0.0823	pCi/Sample	01/07/15 08:19	01/09/15 11:39	1
Thorium-232	0.01795	U	0.0350	0.0350	1.00	0.0654	pCi/Sample	01/07/15 08:19	01/09/15 11:39	1
Tracer	MB %Yield	MB Qualifier	Limits					Prepared	Analyzed	Dil Fac
Thorium-229	99.5		30 - 110					01/07/15 08:19	01/09/15 11:39	1

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# QC Sample Results

Client: Tetra Tech EM Inc.  
Project/Site: West Lake Landfill - Filters

TestAmerica Job ID: 160-9986-1

## Method: A-01-R - Isotopic Thorium (Alpha Spectrometry) (Continued)

Lab Sample ID: LCS 160-167107/2-A

Matrix: Filter

Analysis Batch: 167576

Client Sample ID: Lab Control Sample

Prep Type: Total/NA

Prep Batch: 167107

Analyte	Spike Added	LCS Result	LCS Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits
Thorium-230	16.1	17.04		1.61	1.00	0.111	pCi/Samp	106	81 - 118

Tracer	LCS %Yield	LCS Qualifier	Limits
Thorium-229	92.1		30 - 110

Lab Sample ID: LCSD 160-167107/3-A

Matrix: Filter

Analysis Batch: 167577

Client Sample ID: Lab Control Sample Dup

Prep Type: Total/NA

Prep Batch: 167107

Analyte	Spike Added	LCSD Result	LCSD Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits	RER	RER Limit
Thorium-230	16.1	17.82		1.69	1.00	0.0645	pCi/Samp	111	81 - 118	0.24	1

Tracer	LCSD %Yield	LCSD Qualifier	Limits
Thorium-229	84.8		30 - 110

## Method: A-01-R - Isotopic Uranium (Alpha Spectrometry)

Lab Sample ID: MB 160-167108/1-A

Matrix: Filter

Analysis Batch: 167587

Client Sample ID: Method Blank

Prep Type: Total/NA

Prep Batch: 167108

Analyte	MB Result	MB Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Uranium-233/234	0.07073	U	0.0609	0.0612	1.00	0.0869	pCi/Sample	01/07/15 08:19	01/09/15 11:41	1
Uranium-235/236	0.009779	U	0.0196	0.0196	1.00	0.0293	pCi/Sample	01/07/15 08:19	01/09/15 11:41	1
Uranium-238	0.02353		0.0272	0.0272	1.00	0.0235	pCi/Sample	01/07/15 08:19	01/09/15 11:41	1

Tracer	MB %Yield	MB Qualifier	Limits	Prepared	Analyzed	Dil Fac
Uranium-232	91.4		30 - 110	01/07/15 08:19	01/09/15 11:41	1

Lab Sample ID: LCS 160-167108/2-A

Matrix: Filter

Analysis Batch: 167588

Client Sample ID: Lab Control Sample

Prep Type: Total/NA

Prep Batch: 167108

Analyte	Spike Added	LCS Result	LCS Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits
Uranium-233/234	25.5	25.69		2.37	1.00	0.0714	pCi/Samp	101	84 - 120
Uranium-238	26.0	25.18		2.33	1.00	0.0279	pCi/Samp	97	82 - 122

Tracer	LCS %Yield	LCS Qualifier	Limits
Uranium-232	77.9		30 - 110

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# QC Sample Results

Client: Tetra Tech EM Inc.  
Project/Site: West Lake Landfill - Filters

TestAmerica Job ID: 160-9986-1

## Method: A-01-R - Isotopic Uranium (Alpha Spectrometry) (Continued)

Lab Sample ID: LCSD 160-167108/3-A

Matrix: Filter

Analysis Batch: 167589

Client Sample ID: Lab Control Sample Dup

Prep Type: Total/NA

Prep Batch: 167108

Analyte	Spike Added	LCSD Result	LCSD Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits	RER	RER Limit
Uranium-233/234	25.5	24.95		2.29	1.00	0.0827	pCi/Samp	98	84 - 120	0.16	1
Uranium-238	26.0	25.90		2.37	1.00	0.0259	pCi/Samp	99	82 - 122	0.15	1
Tracer	LCSD %Yield	LCSD Qualifier	Limits								
Uranium-232	86.5		30 - 110								

# QC Association Summary

Client: Tetra Tech EM Inc.  
Project/Site: West Lake Landfill - Filters

TestAmerica Job ID: 160-9986-1

## Rad

### Prep Batch: 167107

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-9986-1	WAA-01-AF-PS-20141223	Total/NA	Filter	ExtChrom	
160-9986-2	WAA-02-AF-PS-20141223	Total/NA	Filter	ExtChrom	
160-9986-3	WAA-03-AF-PS-20141223	Total/NA	Filter	ExtChrom	
160-9986-4	WAA-04-AF-PS-20141223	Total/NA	Filter	ExtChrom	
160-9986-5	WAA-05-AF-PS-20141223	Total/NA	Filter	ExtChrom	
160-9986-6	WAA-00-AF-FB-20141223	Total/NA	Filter	ExtChrom	
LCS 160-167107/2-A	Lab Control Sample	Total/NA	Filter	ExtChrom	
LCSD 160-167107/3-A	Lab Control Sample Dup	Total/NA	Filter	ExtChrom	
MB 160-167107/1-A	Method Blank	Total/NA	Filter	ExtChrom	

### Prep Batch: 167108

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-9986-1	WAA-01-AF-PS-20141223	Total/NA	Filter	ExtChrom	
160-9986-2	WAA-02-AF-PS-20141223	Total/NA	Filter	ExtChrom	
160-9986-3	WAA-03-AF-PS-20141223	Total/NA	Filter	ExtChrom	
160-9986-4	WAA-04-AF-PS-20141223	Total/NA	Filter	ExtChrom	
160-9986-5	WAA-05-AF-PS-20141223	Total/NA	Filter	ExtChrom	
160-9986-6	WAA-00-AF-FB-20141223	Total/NA	Filter	ExtChrom	
LCS 160-167108/2-A	Lab Control Sample	Total/NA	Filter	ExtChrom	
LCSD 160-167108/3-A	Lab Control Sample Dup	Total/NA	Filter	ExtChrom	
MB 160-167108/1-A	Method Blank	Total/NA	Filter	ExtChrom	

### Prep Batch: 167121

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-9986-1	WAA-01-AF-PS-20141223	Total/NA	Filter	DPS-0	
160-9986-2	WAA-02-AF-PS-20141223	Total/NA	Filter	DPS-0	
160-9986-3	WAA-03-AF-PS-20141223	Total/NA	Filter	DPS-0	
160-9986-4	WAA-04-AF-PS-20141223	Total/NA	Filter	DPS-0	
160-9986-5	WAA-05-AF-PS-20141223	Total/NA	Filter	DPS-0	
160-9986-6	WAA-00-AF-FB-20141223	Total/NA	Filter	DPS-0	
LCS 160-167121/2-A	Lab Control Sample	Total/NA	Filter	DPS-0	
LCSD 160-167121/3-A	Lab Control Sample Dup	Total/NA	Filter	DPS-0	
MB 160-167121/1-A	Method Blank	Total/NA	Filter	DPS-0	



## Tracer/Carrier Summary

Client: Tetra Tech EM Inc.  
Project/Site: West Lake Landfill - Filters

TestAmerica Job ID: 160-9986-1

### Method: 9315 - Total Apha Radium (GFPC)

Matrix: Filter

Prep Type: Total/NA

		Percent Yield (Acceptance Limits)					
Lab Sample ID	Client Sample ID	Ba (40-110)					
160-9986-1	WAA-01-AF-PS-20141223	101					
160-9986-2	WAA-02-AF-PS-20141223	100					
160-9986-3	WAA-03-AF-PS-20141223	100					
160-9986-4	WAA-04-AF-PS-20141223	104					
160-9986-5	WAA-05-AF-PS-20141223	102					
160-9986-6	WAA-00-AF-FB-20141223	99.4					
LCS 160-167121/2-A	Lab Control Sample	95.6					
LCSD 160-167121/3-A	Lab Control Sample Dup	95.3					
MB 160-167121/1-A	Method Blank	96.5					
<b>Tracer/Carrier Legend</b>							
Ba = Ba Carrier							

### Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Matrix: Filter

Prep Type: Total/NA

		Percent Yield (Acceptance Limits)					
Lab Sample ID	Client Sample ID	Th-229 (30-110)					
160-9986-1	WAA-01-AF-PS-20141223	80.7					
160-9986-2	WAA-02-AF-PS-20141223	91.2					
160-9986-3	WAA-03-AF-PS-20141223	96.3					
160-9986-4	WAA-04-AF-PS-20141223	91.4					
160-9986-5	WAA-05-AF-PS-20141223	96.8					
160-9986-6	WAA-00-AF-FB-20141223	92.8					
LCS 160-167107/2-A	Lab Control Sample	92.1					
LCSD 160-167107/3-A	Lab Control Sample Dup	84.8					
MB 160-167107/1-A	Method Blank	99.5					
<b>Tracer/Carrier Legend</b>							
Th-229 = Thorium-229							

### Method: A-01-R - Isotopic Uranium (Alpha Spectrometry)

Matrix: Filter

Prep Type: Total/NA

		Percent Yield (Acceptance Limits)					
Lab Sample ID	Client Sample ID	U-232 (30-110)					
160-9986-1	WAA-01-AF-PS-20141223	94.8					
160-9986-2	WAA-02-AF-PS-20141223	95.6					
160-9986-3	WAA-03-AF-PS-20141223	87.9					
160-9986-4	WAA-04-AF-PS-20141223	87.6					
160-9986-5	WAA-05-AF-PS-20141223	92.1					
160-9986-6	WAA-00-AF-FB-20141223	93.2					
LCS 160-167108/2-A	Lab Control Sample	77.9					
LCSD 160-167108/3-A	Lab Control Sample Dup	86.5					
MB 160-167108/1-A	Method Blank	91.4					
<b>Tracer/Carrier Legend</b>							
U-232 = Uranium-232							

TestAmerica St. Louis

**Tetra Tech, Inc.**  
**DATA VALIDATION REPORT**  
**LEVEL II**

Site: West Lake Landfill Site, Bridgeton, Missouri

Laboratory: TestAmerica Laboratories, Inc. (Earth City, Missouri)

Data Reviewer: Harry Ellis, Tetra Tech, Inc. (Tetra Tech)

Review Date: February 25, 2015

Sample Delivery Group (SDG): J10012

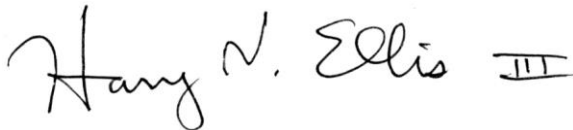
Sample Numbers: WAA-01-AF-PS-20141231, WAA-02-AF-PS-20141231, WAA-03-AF-PS-20141231, WAA-04-AF-PS-20141231, WAA-05-AF-PS-20141231, and WAA-00-AF-FB-20141231

Matrix / Number of Samples: 5 Air Samples and 1 Field Blank

The data were qualified according to the U.S. Environmental Protection Agency (EPA) Region 7 documents entitled "Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review" (9240.1-48), June 2008. In addition, the Tetra Tech document "Review of Data Packages from Subcontracted Laboratories" (February 2002) and the EPA and others document "Multi-Agency Radiological Laboratory Analytical Protocols Manual" (July 2004) were used along with other criteria specified in the applicable methods.

The review was intended to identify problems and quality control (QC) deficiencies that were readily apparent from the summary data package. The following sections discuss any problems or deficiencies that were found, and data qualifications applied because of non-compliant QC. The data review was limited to the available field and laboratory QC information submitted with the project-specific data package.

I, Harry Ellis, certify that all data validation criteria outlined in the above-referenced documents were assessed, and any qualifications made to the data accorded with those documents.



25 February 2015

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Certified by Harry Ellis, Chemist

---

Date

## DATA VALIDATION QUALIFIERS

- U** — The analyte was not detected above the reported sample quantitation limit.
- J** — The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.
- UJ** — The analyte was not detected above the reported sample quantitation limit, which is estimated.
- R** — The sample results are rejected due to serious deficiencies in the ability to analyze the sample and meet QC criteria. Presence or absence of the analyte cannot be verified.

## **DATA ASSESSMENT**

Sample delivery group (SDG) J10012 included five (5) environmental air (filter) samples and one (1) QC sample (a field blank). Samples were analyzed for total alpha-emitting radium by EPA SW-846 Method 9315 and for isotopic (alpha-emitting) thorium and uranium by Department of Energy (DOE) Method A-01-R. The following summarizes the data validation that was performed.

### **RADIOANALYTICAL ANALYSES**

#### **I. Holding Time and Chain of Custody (COC) Requirements**

The samples were received by the laboratory and analyzed within the established holding time of 6 months from sample collection to analysis. No data were qualified.

#### **II. Matrix Spike/Matrix Spike Duplicate (MS/MSD)**

Insufficient sample was available for MS/MSD analyses. Duplicate LCS analysis provided adequate data on precision and accuracy. No qualifications were applied.

#### **III. Blanks**

The laboratory (method) blank and field blank yielded low activities for one (of three) thorium isotopes and for none (of three) uranium isotopes. No qualifications were applied.

#### **IV. Laboratory Control Sample (LCS)**

All percent recoveries and relative percent differences from the duplicate LCS analyses were within established control limits.

#### **V. Surrogates**

These radioanalytical methods use a “carrier” or “tracer”, whose recovery serves the same functions as surrogate recoveries. All carrier and tracer recoveries were within the laboratory’s QC limits. No qualifications were applied.

#### **VI. Comments**

All detected results were less than their reporting limits (“RL”). These extrapolations should be qualified as estimated (flagged “J”).

#### **VII. Overall Assessment of Data**

Overall data quality is acceptable, with few qualifications applied. All data are usable as qualified for their intended purposes.

# TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

## ANALYTICAL REPORT

TestAmerica Laboratories, Inc.

TestAmerica St. Louis  
13715 Rider Trail North  
Earth City, MO 63045  
Tel: (314)298-8566

TestAmerica Job ID: 160-10012-1

Client Project/Site: West Lake Landfill - Filters

For:

Tetra Tech EM Inc.  
415 Oak Street  
Kansas City, Missouri 64106

Attn: Ms. Emily Fisher

*Rhonda Ridenhower*

Authorized for release by:

1/29/2015 10:28:35 AM

Rhonda Ridenhower, Manager of Project Management  
[rhonda.ridenhower@testamericainc.com](mailto:rhonda.ridenhower@testamericainc.com)

Designee for

Erika Gish, Project Manager II  
(314)298-8566  
[erika.gish@testamericainc.com](mailto:erika.gish@testamericainc.com)

### LINKS

Review your project  
results through

TotalAccess

Have a Question?



Visit us at:

[www.testamericainc.com](http://www.testamericainc.com)

*This report has been electronically signed and authorized by the signatory. Electronic signature is intended to be the legally binding equivalent of a traditionally handwritten signature.*

*Results relate only to the items tested and the sample(s) as received by the laboratory.*

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## Case Narrative

Client: Tetra Tech EM Inc.  
Project/Site: West Lake Landfill - Filters

TestAmerica Job ID: 160-10012-1

**Job ID: 160-10012-1**

**Laboratory: TestAmerica St. Louis**

### Narrative

## CASE NARRATIVE

**Client: Tetra Tech EM Inc.**

**Project: West Lake Landfill - Filters**

**Report Number: 160-10012-1**

With the exceptions noted as flags or footnotes, standard analytical protocols were followed in the analysis of the samples and no problems were encountered or anomalies observed. In addition all laboratory quality control samples were within established control limits, with any exceptions noted below. Each sample was analyzed to achieve the lowest possible reporting limit within the constraints of the method. In some cases, due to interference or analytes present at high concentrations, samples were diluted. For diluted samples, the reporting limits are adjusted relative to the dilution required.

TestAmerica St. Louis attests to the validity of the laboratory data generated by TestAmerica facilities reported herein. All analyses performed by TestAmerica facilities were done using established laboratory SOPs that incorporate QA/QC procedures described in the application methods. TestAmerica's operations groups have reviewed the data for compliance with the laboratory QA/QC plan, and data have been found to be compliant with laboratory protocols unless otherwise noted below.

The test results in this report meet all NELAP requirements for parameters for which accreditation is required or available. Any exceptions to NELAP requirements are noted in this report. Pursuant to NELAP, this report may not be reproduced, except in full, without the written approval of the laboratory.

Calculations are performed before rounding to avoid round-off errors in calculated results.

All holding times were met and proper preservation noted for the methods performed on these samples, unless otherwise detailed in the individual sections below.

All solid sample results for Chemistry analyses are reported on an "as received" basis unless otherwise indicated by the presence of a % solids value in the method header. All soil/sediment sample results for radiochemistry analyses are based upon sample as dried and disaggregated with the exception of tritium, carbon-14, and iodine-129 by gamma spectroscopy unless requested as wet weight by the client."

This laboratory report is confidential and is intended for the sole use of TestAmerica and its client.

### RECEIPT

The samples were received on 01/05/2015; the samples arrived in good condition, properly preserved. The temperature of the coolers at receipt was 20.0 C.

The following samples are filters that were split between multiple analyses: WAA-00-AF-FB-20141231 (160-10012-6), WAA-01-AF-PS-20141231 (160-10012-1), WAA-02-AF-PS-20141231 (160-10012-2), WAA-03-AF-PS-20141231 (160-10012-3), WAA-04-AF-PS-20141231 (160-10012-4), WAA-05-AF-PS-20141231 (160-10012-5). A LCS/LCSD was performed as batch QC.

### TOTAL ALPHA RADIUM (GFPC)

Samples WAA-01-AF-PS-20141231 (160-10012-1), WAA-02-AF-PS-20141231 (160-10012-2), WAA-03-AF-PS-20141231 (160-10012-3), WAA-04-AF-PS-20141231 (160-10012-4), WAA-05-AF-PS-20141231 (160-10012-5) and WAA-00-AF-FB-20141231 (160-10012-6) were analyzed for Total Alpha Radium (GFPC) in accordance with SW- 846 Method 9315. The samples were prepared on 01/13/2015 and analyzed on 01/23/2015.

No analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

## Case Narrative

Client: Tetra Tech EM Inc.  
Project/Site: West Lake Landfill - Filters

TestAmerica Job ID: 160-10012-1

### Job ID: 160-10012-1 (Continued)

#### Laboratory: TestAmerica St. Louis (Continued)

##### ISOTOPIC THORIUM (ALPHA SPECTROMETRY)

Samples WAA-01-AF-PS-20141231 (160-10012-1), WAA-02-AF-PS-20141231 (160-10012-2), WAA-03-AF-PS-20141231 (160-10012-3), WAA-04-AF-PS-20141231 (160-10012-4), WAA-05-AF-PS-20141231 (160-10012-5) and WAA-00-AF-FB-20141231 (160-10012-6) were analyzed for Isotopic Thorium (Alpha Spectrometry) in accordance with A-01-R. The samples were prepared on 01/13/2015 and analyzed on 01/14/2015.

No analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

##### ISOTOPIC URANIUM (ALPHA SPECTROMETRY)

Samples WAA-01-AF-PS-20141231 (160-10012-1), WAA-02-AF-PS-20141231 (160-10012-2), WAA-03-AF-PS-20141231 (160-10012-3), WAA-04-AF-PS-20141231 (160-10012-4), WAA-05-AF-PS-20141231 (160-10012-5) and WAA-00-AF-FB-20141231 (160-10012-6) were analyzed for Isotopic Uranium (Alpha Spectrometry) in accordance with A-01-R. The samples were prepared on 01/13/2015 and analyzed on 01/14/2015.

No analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.



## Chain of Custody Record

Regulatory Program: ☐ DW ☐ NPDES ☐ RCRA ☐ Other:

1520K

[illegible]

## Login Sample Receipt Checklist

Client: Tetra Tech EM Inc.

Job Number: 160-10012-1

Login Number: 10012

List Source: TestAmerica St. Louis

List Number: 1

Creator: Clarke, Jill C

Question	Answer	Comment
Radioactivity wasn't checked or is $\leq$ background as measured by a survey meter.	True	
The cooler's custody seal, if present, is intact.	N/A	
Sample custody seals, if present, are intact.	True	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	N/A	
Cooler Temperature is acceptable.	True	
Cooler Temperature is recorded.	True	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	N/A	
There are no discrepancies between the containers received and the COC.	True	
Samples are received within Holding Time.	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified.	True	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
Containers requiring zero headspace have no headspace or bubble is $<6\text{mm}$ (1/4").	N/A	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Residual Chlorine Checked.	N/A	

## Definitions/Glossary

Client: Tetra Tech EM Inc.  
Project/Site: West Lake Landfill - Filters

TestAmerica Job ID: 160-10012-1

### Qualifiers

#### Rad

Qualifier	Qualifier Description
U	Result is less than the sample detection limit.

### Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
α	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
CFL	Contains Free Liquid
CNF	Contains no Free Liquid
DER	Duplicate error ratio (normalized absolute difference)
Dil Fac	Dilution Factor
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision level concentration
MDA	Minimum detectable activity
EDL	Estimated Detection Limit
MDC	Minimum detectable concentration
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
NC	Not Calculated
ND	Not detected at the reporting limit (or MDL or EDL if shown)
PQL	Practical Quantitation Limit
QC	Quality Control
RER	Relative error ratio
RL	Reporting Limit or Requested Limit (Radiochemistry)
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)

## Method Summary

Client: Tetra Tech EM Inc.  
Project/Site: West Lake Landfill - Filters

TestAmerica Job ID: 160-10012-1

Method	Method Description	Protocol	Laboratory
9315	Total Alpha Radium (GFPC)	SW846	TAL SL
A-01-R	Isotopic Thorium (Alpha Spectrometry)	DOE	TAL SL
A-01-R	Isotopic Uranium (Alpha Spectrometry)	DOE	TAL SL

### Protocol References:

DOE = U.S. Department of Energy

SW846 = "Test Methods For Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 And Its Updates.

### Laboratory References:

TAL SL = TestAmerica St. Louis, 13715 Rider Trail North, Earth City, MO 63045, TEL (314)298-8566

## Sample Summary

Client: Tetra Tech EM Inc.

TestAmerica Job ID: 160-10012-1

Project/Site: West Lake Landfill - Filters

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
160-10012-1	WAA-01-AF-PS-20141231	Filter	12/31/14 10:17	01/05/15 12:45
160-10012-2	WAA-02-AF-PS-20141231	Filter	12/31/14 10:33	01/05/15 12:45
160-10012-3	WAA-03-AF-PS-20141231	Filter	12/31/14 11:14	01/05/15 12:45
160-10012-4	WAA-04-AF-PS-20141231	Filter	12/31/14 11:30	01/05/15 12:45
160-10012-5	WAA-05-AF-PS-20141231	Filter	12/31/14 10:50	01/05/15 12:45
160-10012-6	WAA-00-AF-FB-20141231	Filter	12/31/14 00:00	01/05/15 12:45

# Client Sample Results

Client: Tetra Tech EM Inc.  
Project/Site: West Lake Landfill - Filters

TestAmerica Job ID: 160-10012-1

Client Sample ID: WAA-01-AF-PS-20141231

Lab Sample ID: 160-10012-1

Date Collected: 12/31/14 10:17

Matrix: Filter

Date Received: 01/05/15 12:45

## Method: 9315 - Total Alpha Radium (GFPC)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Total Alpha Radium	0.0492	U	0.306	0.306	1.00	0.589	pCi/Sample	01/13/15 12:12	01/23/15 09:40	1
Carrier	% Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Ba Carrier	101		40 - 110					01/13/15 12:12	01/23/15 09:40	1

## Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.0590	U	0.119	0.119	1.00	0.234	pCi/Sample	01/13/15 07:50	01/14/15 13:20	1
Thorium-230	0.304	J	0.233	0.235	1.00	0.234	pCi/Sample	01/13/15 07:50	01/14/15 13:20	1
Thorium-232	0.0409	U	0.0818	0.0818	1.00	0.123	pCi/Sample	01/13/15 07:50	01/14/15 13:20	1
Tracer	% Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Thorium-229	93.7		30 - 110					01/13/15 07:50	01/14/15 13:20	1

## Method: A-01-R - Isotopic Uranium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Uranium-233/234	0.218	U	0.212	0.213	1.00	0.245	pCi/Sample	01/13/15 07:50	01/14/15 13:23	1
Uranium-235/236	0.000	U	0.0220	0.0220	1.00	0.176	pCi/Sample	01/13/15 07:50	01/14/15 13:23	1
Uranium-238	-0.0353	U	0.0353	0.0354	1.00	0.287	pCi/Sample	01/13/15 07:50	01/14/15 13:23	1
Tracer	% Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Uranium-232	82.1		30 - 110					01/13/15 07:50	01/14/15 13:23	1

Client Sample ID: WAA-02-AF-PS-20141231

Lab Sample ID: 160-10012-2

Date Collected: 12/31/14 10:33

Matrix: Filter

Date Received: 01/05/15 12:45

## Method: 9315 - Total Alpha Radium (GFPC)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Total Alpha Radium	0.290	U	0.370	0.371	1.00	0.616	pCi/Sample	01/13/15 12:12	01/23/15 09:41	1
Carrier	% Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Ba Carrier	96.8		40 - 110					01/13/15 12:12	01/23/15 09:41	1

## Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.00816	U	0.163	0.163	1.00	0.392	pCi/Sample	01/13/15 07:50	01/14/15 13:20	1
Thorium-230	0.267	U	0.234	0.235	1.00	0.281	pCi/Sample	01/13/15 07:50	01/14/15 13:20	1
Thorium-232	0.0866	U	0.122	0.123	1.00	0.130	pCi/Sample	01/13/15 07:50	01/14/15 13:20	1

HUE 25 Feb 15

TestAmerica St. Louis

# Client Sample Results

Client: Tetra Tech EM Inc.  
Project/Site: West Lake Landfill - Filters

TestAmerica Job ID 160-10012-1

Client Sample ID: WAA-02-AF-PS-20141231

Lab Sample ID: 160-10012-2

Date Collected: 12/31/14 10:33

Matrix: Filter

Date Received: 01/05/15 12:45

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	86.3		30 - 110	01/13/15 07:50	01/14/15 13:20	1

Method: A-01-R - Isotopic Uranium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Uranium-233/234	0.134	U	0.179	0.179	1.00	0.284	pCi/Sample	01/13/15 07:50	01/14/15 13:23	1
Uranium-235/236	0.0886	U	0.157	0.157	1.00	0.283	pCi/Sample	01/13/15 07:50	01/14/15 13:23	1
Uranium-238	0.0547	U	0.128	0.128	1.00	0.267	pCi/Sample	01/13/15 07:50	01/14/15 13:23	1

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Uranium-232	83.7		30 - 110	01/13/15 07:50	01/14/15 13:23	1

Client Sample ID: WAA-03-AF-PS-20141231

Lab Sample ID: 160-10012-3

Date Collected: 12/31/14 11:14

Matrix: Filter

Date Received: 01/05/15 12:45

Method: 9315 - Total Alpha Radium (GFPC)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Total Alpha Radium	0.240	U	0.413	0.413	1.00	0.715	pCi/Sample	01/13/15 12:12	01/23/15 09:41	1

Carrier	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Ba Carrier	101		40 - 110	01/13/15 12:12	01/23/15 09:41	1

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.0960	U	0.151	0.151	1.00	0.261	pCi/Sample	01/13/15 07:50	01/14/15 13:20	1
Thorium-230	0.367	U	0.257	0.259	1.00	0.222	pCi/Sample	01/13/15 07:50	01/14/15 13:20	1
Thorium-232	-0.00797	U	0.0159	0.0159	1.00	0.193	pCi/Sample	01/13/15 07:50	01/14/15 13:20	1

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	88.5		30 - 110	01/13/15 07:50	01/14/15 13:20	1

Method: A-01-R - Isotopic Uranium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Uranium-233/234	0.123	U	0.165	0.165	1.00	0.244	pCi/Sample	01/13/15 07:50	01/14/15 13:23	1
Uranium-235/236	0.000	U	0.0219	0.0219	1.00	0.175	pCi/Sample	01/13/15 07:50	01/14/15 13:23	1
Uranium-238	0.0937	U	0.133	0.133	1.00	0.141	pCi/Sample	01/13/15 07:50	01/14/15 13:23	1

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Uranium-232	80.5		30 - 110	01/13/15 07:50	01/14/15 13:23	1

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# Client Sample Results

Client: Tetra Tech EM Inc.  
Project/Site: West Lake Landfill - Filters

TestAmerica Job ID: 160-10012-1

Client Sample ID: WAA-04-AF-PS-20141231

Lab Sample ID: 160-10012-4

Date Collected: 12/31/14 11:30

Matrix: Filter

Date Received: 01/05/15 12:45

## Method: 9315 - Total Alpha Radium (GFPC)

Analyte	Result	Qualifier	Count Uncert.	Total Uncert.	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Total Alpha Radium	0.109	U	(2σ+/-) 0.405	(2σ+/-) 0.405	1.00	0.737	pCi/Sample	01/13/15 12:12	01/23/15 12:37	1
Carrier	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Ba Carrier	99.4		40 - 110					01/13/15 12:12	01/23/15 12:37	1

## Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert.	Total Uncert.	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.0934	U	(2σ+/-) 0.202	(2σ+/-) 0.203	1.00	0.389	pCi/Sample	01/13/15 07:50	01/14/15 13:20	1
Thorium-230	0.145	U	(2σ+/-) 0.173	(2σ+/-) 0.174	1.00	0.245	pCi/Sample	01/13/15 07:50	01/14/15 13:20	1
Thorium-232	0.0696	U	(2σ+/-) 0.123	(2σ+/-) 0.123	1.00	0.223	pCi/Sample	01/13/15 07:50	01/14/15 13:20	1
Tracer	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Thorium-229	88.6		30 - 110					01/13/15 07:50	01/14/15 13:20	1

## Method: A-01-R - Isotopic Uranium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert.	Total Uncert.	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Uranium-233/234	0.0543	U	(2σ+/-) 0.127	(2σ+/-) 0.127	1.00	0.265	pCi/Sample	01/13/15 07:50	01/14/15 13:23	1
Uranium-235/236	-0.0101	U	(2σ+/-) 0.0203	(2σ+/-) 0.0203	1.00	0.246	pCi/Sample	01/13/15 07:50	01/14/15 13:23	1
Uranium-238	0.0352	U	(2σ+/-) 0.0882	(2σ+/-) 0.0882	1.00	0.197	pCi/Sample	01/13/15 07:50	01/14/15 13:23	1
Tracer	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Uranium-232	86.2		30 - 110					01/13/15 07:50	01/14/15 13:23	1

Client Sample ID: WAA-05-AF-PS-20141231

Lab Sample ID: 160-10012-5

Date Collected: 12/31/14 10:50

Matrix: Filter

Date Received: 01/05/15 12:45

## Method: 9315 - Total Alpha Radium (GFPC)

Analyte	Result	Qualifier	Count Uncert.	Total Uncert.	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Total Alpha Radium	0.199	U	(2σ+/-) 0.391	(2σ+/-) 0.391	1.00	0.686	pCi/Sample	01/13/15 12:12	01/23/15 12:37	1
Carrier	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Ba Carrier	102		40 - 110					01/13/15 12:12	01/23/15 12:37	1

## Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert.	Total Uncert.	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.100	U	(2σ+/-) 0.198	(2σ+/-) 0.198	1.00	0.372	pCi/Sample	01/13/15 07:50	01/14/15 13:20	1
Thorium-230	0.709	U	(2σ+/-) 0.348	(2σ+/-) 0.353	1.00	0.191	pCi/Sample	01/13/15 07:50	01/14/15 13:20	1
Thorium-232	0.0604	U	(2σ+/-) 0.122	(2σ+/-) 0.122	1.00	0.239	pCi/Sample	01/13/15 07:50	01/14/15 13:20	1
Tracer	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Thorium-229	89.9		30 - 110					01/13/15 07:50	01/14/15 13:20	1

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# Client Sample Results

Client: Tetra Tech EM Inc.  
Project/Site: West Lake Landfill - Filters

TestAmerica Job ID: 160-10012-1

Client Sample ID: WAA-05-AF-PS-20141231

Lab Sample ID: 160-10012-5

Date Collected: 12/31/14 10:50

Matrix: Filter

Date Received: 01/05/15 12:45

## Method: A-01-R - Isotopic Uranium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Uranium-233/234	0.116	U	0.155	0.156	1.00	0.230	pCi/Sample	01/13/15 07:50	01/14/15 13:23	1
Uranium-235/236	-0.0104	U	0.0207	0.0207	1.00	0.251	pCi/Sample	01/13/15 07:50	01/14/15 13:23	1
Uranium-238	0.0111	U	0.0946	0.0946	1.00	0.270	pCi/Sample	01/13/15 07:50	01/14/15 13:23	1
Tracer	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Uranium-232	81.2		30 - 110					01/13/15 07:50	01/14/15 13:23	1

Client Sample ID: WAA-00-AF-FB-20141231

Lab Sample ID: 160-10012-6

Date Collected: 12/31/14 00:00

Matrix: Filter

Date Received: 01/05/15 12:45

## Method: 9315 - Total Alpha Radium (GFPC)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Total Alpha Radium	0.349	U	0.385	0.387	1.00	0.624	pCi/Sample	01/13/15 12:12	01/23/15 12:37	1
Carrier	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Ba Carrier	103		40 - 110					01/13/15 12:12	01/23/15 12:37	1

## Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.00701	U	0.157	0.157	1.00	0.404	pCi/Sample	01/13/15 07:50	01/14/15 13:20	1
Thorium-230	0.648	U	0.370	0.374	1.00	0.266	pCi/Sample	01/13/15 07:50	01/14/15 13:20	1
Thorium-232	0.000	U	0.0191	0.0191	1.00	0.153	pCi/Sample	01/13/15 07:50	01/14/15 13:20	1
Tracer	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Thorium-229	74.5		30 - 110					01/13/15 07:50	01/14/15 13:20	1

## Method: A-01-R - Isotopic Uranium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Uranium-233/234	0.0756	U	0.204	0.204	1.00	0.416	pCi/Sample	01/13/15 07:50	01/14/15 13:23	1
Uranium-235/236	0.0489	U	0.123	0.123	1.00	0.274	pCi/Sample	01/13/15 07:50	01/14/15 13:23	1
Uranium-238	-0.0543	U	0.0444	0.0446	1.00	0.329	pCi/Sample	01/13/15 07:50	01/14/15 13:23	1
Tracer	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Uranium-232	79.5		30 - 110					01/13/15 07:50	01/14/15 13:23	1

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# QC Sample Results

Client: Tetra Tech EM Inc.  
Project/Site: West Lake Landfill - Filters

TestAmerica Job ID: 160-10012-1

## Method: 9315 - Total Apha Radium (GFPC)

Lab Sample ID: MB 160-168177/1-A

Matrix: Filter

Analysis Batch: 170022

Client Sample ID: Method Blank

Prep Type: Total/NA

Prep Batch: 168177

Analyte	MB Result	MB Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Total Alpha Radium	-0.3395	U	0.374	0.375	1.00	0.832	pCi/Sample	01/13/15 12:12	01/23/15 09:40	1
Carrier	MB %Yield	MB Qualifier	Limits					Prepared	Analyzed	Dil Fac
Ba Carrier	96.5		40 - 110					01/13/15 12:12	01/23/15 09:40	1

Lab Sample ID: LCS 160-168177/2-A

Matrix: Filter

Analysis Batch: 170022

Client Sample ID: Lab Control Sample

Prep Type: Total/NA

Prep Batch: 168177

Analyte	Spike Added	LCS Result	LCS Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits	
Total Alpha Radium	45.0	44.76		4.96	1.00	0.947	pCi/Samp	100	65 - 150	
Carrier	LCS %Yield	LCS Qualifier	Limits							
Ba Carrier	92.6		40 - 110							

Lab Sample ID: LCSD 160-168177/3-A

Matrix: Filter

Analysis Batch: 170022

Client Sample ID: Lab Control Sample Dup

Prep Type: Total/NA

Prep Batch: 168177

Analyte	Spike Added	LCSD Result	LCSD Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits	RER	RER Limit
Total Alpha Radium	45.0	43.92		4.73	1.00	0.724	pCi/Samp	98	65 - 150	0.09	1
Carrier	LCSD %Yield	LCSD Qualifier	Limits								
Ba Carrier	94.7		40 - 110								

## Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Lab Sample ID: MB 160-168044/1-A

Matrix: Filter

Analysis Batch: 168461

Client Sample ID: Method Blank

Prep Type: Total/NA

Prep Batch: 168044

Analyte	MB Result	MB Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	-0.02872	U	0.147	0.147	1.00	0.381	pCi/Sample	01/13/15 07:50	01/14/15 13:19	1
Thorium-230	0.2469		0.204	0.205	1.00	0.217	pCi/Sample	01/13/15 07:50	01/14/15 13:19	1
Thorium-232	-0.01430	U	0.0202	0.0203	1.00	0.198	pCi/Sample	01/13/15 07:50	01/14/15 13:19	1
Tracer	MB %Yield	MB Qualifier	Limits					Prepared	Analyzed	Dil Fac
Thorium-229	99.8		30 - 110					01/13/15 07:50	01/14/15 13:19	1

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# QC Sample Results

Client: Tetra Tech EM Inc.  
Project/Site: West Lake Landfill - Filters

TestAmerica Job ID: 160-10012-1

## Method: A-01-R - Isotopic Thorium (Alpha Spectrometry) (Continued)

Lab Sample ID: LCS 160-168044/2-A

Matrix: Filter

Analysis Batch: 168462

Client Sample ID: Lab Control Sample

Prep Type: Total/NA

Prep Batch: 168044

Analyte	Spike Added	LCS Result	LCS Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits
Thorium-230	16.1	17.70		2.27	1.00	0.235	pCi/Samp	110	81 - 118
Tracer	LCS %Yield	LCS Qualifier	Limits						
Thorium-229	92.3		30 - 110						

Lab Sample ID: LCSD 160-168044/3-A

Matrix: Filter

Analysis Batch: 168463

Client Sample ID: Lab Control Sample Dup

Prep Type: Total/NA

Prep Batch: 168044

Analyte	Spike Added	LCSD Result	LCSD Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits	RER	RER Limit
Thorium-230	16.1	18.64		2.40	1.00	0.327	pCi/Samp	116	81 - 118	0.20	1
Tracer	LCSD %Yield	LCSD Qualifier	Limits								
Thorium-229	84.7		30 - 110								

## Method: A-01-R - Isotopic Uranium (Alpha Spectrometry)

Lab Sample ID: MB 160-168045/1-A

Matrix: Filter

Analysis Batch: 168472

Client Sample ID: Method Blank

Prep Type: Total/NA

Prep Batch: 168045

Analyte	MB Result	MB Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Uranium-233/234	-0.03842	U	0.102	0.102	1.00	0.347	pCi/Sample	01/13/15 07:50	01/14/15 13:23	1
Uranium-235/236	-0.02049	U	0.0290	0.0290	1.00	0.284	pCi/Sample	01/13/15 07:50	01/14/15 13:23	1
Uranium-238	0.07395	U	0.158	0.158	1.00	0.311	pCi/Sample	01/13/15 07:50	01/14/15 13:23	1
Tracer	MB %Yield	MB Qualifier	Limits							
Uranium-232	89.6		30 - 110							
								Prepared	Analyzed	Dil Fac
								01/13/15 07:50	01/14/15 13:23	1

Lab Sample ID: LCS 160-168045/2-A

Matrix: Filter

Analysis Batch: 168473

Client Sample ID: Lab Control Sample

Prep Type: Total/NA

Prep Batch: 168045

Analyte	Spike Added	LCS Result	LCS Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits
Uranium-233/234	25.5	23.16		2.87	1.00	0.251	pCi/Samp	91	84 - 120
Uranium-238	26.0	24.73		3.02	1.00	0.294	pCi/Samp	95	82 - 122
Tracer	LCS %Yield	LCS Qualifier	Limits						
Uranium-232	74.9		30 - 110						

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# QC Sample Results

Client: Tetra Tech EM Inc.  
Project/Site: West Lake Landfill - Filters

TestAmerica Job ID: 160-10012-1

## Method: A-01-R - Isotopic Uranium (Alpha Spectrometry) (Continued)

Lab Sample ID: LCSD 160-168045/3-A

Matrix: Filter

Analysis Batch: 168474

Client Sample ID: Lab Control Sample Dup

Prep Type: Total/NA

Prep Batch: 168045

Analyte	Spike Added	LCSD Result	LCSD Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits	RER	RER Limit
Uranium-233/234	25.5	23.01		2.86	1.00	0.313	pCi/Samp	90	84 - 120	0.03	1
Uranium-238	26.0	24.05		2.95	1.00	0.251	pCi/Samp	92	82 - 122	0.11	1
<b>Tracer</b>	<b>LCSD %Yield</b>	<b>LCSD Qualifier</b>	<b>Limits</b>								
Uranium-232	76.5		30 - 110								

# QC Association Summary

Client: Tetra Tech EM Inc.  
Project/Site: West Lake Landfill - Filters

TestAmerica Job ID: 160-10012-1

## Rad

### Prep Batch: 168044

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-10012-1	WAA-01-AF-PS-20141231	Total/NA	Filter	ExtChrom	
160-10012-2	WAA-02-AF-PS-20141231	Total/NA	Filter	ExtChrom	
160-10012-3	WAA-03-AF-PS-20141231	Total/NA	Filter	ExtChrom	
160-10012-4	WAA-04-AF-PS-20141231	Total/NA	Filter	ExtChrom	
160-10012-5	WAA-05-AF-PS-20141231	Total/NA	Filter	ExtChrom	
160-10012-6	WAA-00-AF-FB-20141231	Total/NA	Filter	ExtChrom	
LCS 160-168044/2-A	Lab Control Sample	Total/NA	Filter	ExtChrom	
LCSD 160-168044/3-A	Lab Control Sample Dup	Total/NA	Filter	ExtChrom	
MB 160-168044/1-A	Method Blank	Total/NA	Filter	ExtChrom	

### Prep Batch: 168045

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-10012-1	WAA-01-AF-PS-20141231	Total/NA	Filter	ExtChrom	
160-10012-2	WAA-02-AF-PS-20141231	Total/NA	Filter	ExtChrom	
160-10012-3	WAA-03-AF-PS-20141231	Total/NA	Filter	ExtChrom	
160-10012-4	WAA-04-AF-PS-20141231	Total/NA	Filter	ExtChrom	
160-10012-5	WAA-05-AF-PS-20141231	Total/NA	Filter	ExtChrom	
160-10012-6	WAA-00-AF-FB-20141231	Total/NA	Filter	ExtChrom	
LCS 160-168045/2-A	Lab Control Sample	Total/NA	Filter	ExtChrom	
LCSD 160-168045/3-A	Lab Control Sample Dup	Total/NA	Filter	ExtChrom	
MB 160-168045/1-A	Method Blank	Total/NA	Filter	ExtChrom	

### Prep Batch: 168177

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-10012-1	WAA-01-AF-PS-20141231	Total/NA	Filter	DPS-0	
160-10012-2	WAA-02-AF-PS-20141231	Total/NA	Filter	DPS-0	
160-10012-3	WAA-03-AF-PS-20141231	Total/NA	Filter	DPS-0	
160-10012-4	WAA-04-AF-PS-20141231	Total/NA	Filter	DPS-0	
160-10012-5	WAA-05-AF-PS-20141231	Total/NA	Filter	DPS-0	
160-10012-6	WAA-00-AF-FB-20141231	Total/NA	Filter	DPS-0	
LCS 160-168177/2-A	Lab Control Sample	Total/NA	Filter	DPS-0	
LCSD 160-168177/3-A	Lab Control Sample Dup	Total/NA	Filter	DPS-0	
MB 160-168177/1-A	Method Blank	Total/NA	Filter	DPS-0	

## Tracer/Carrier Summary

Client: Tetra Tech EM Inc.  
Project/Site: West Lake Landfill - Filters

TestAmerica Job ID: 160-10012-1

### Method: 9315 - Total Apha Radium (GFPC)

Matrix: Filter

Prep Type: Total/NA

		Percent Yield (Acceptance Limits)					
Lab Sample ID	Client Sample ID	Ba (40-110)					
160-10012-1	WAA-01-AF-PS-20141231	101					
160-10012-2	WAA-02-AF-PS-20141231	96.8					
160-10012-3	WAA-03-AF-PS-20141231	101					
160-10012-4	WAA-04-AF-PS-20141231	99.4					
160-10012-5	WAA-05-AF-PS-20141231	102					
160-10012-6	WAA-00-AF-FB-20141231	103					
LCS 160-168177/2-A	Lab Control Sample	92.6					
LCSD 160-168177/3-A	Lab Control Sample Dup	94.7					
MB 160-168177/1-A	Method Blank	96.5					
<b>Tracer/Carrier Legend</b>							
Ba = Ba Carrier							

### Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Matrix: Filter

Prep Type: Total/NA

		Percent Yield (Acceptance Limits)					
Lab Sample ID	Client Sample ID	Th-229 (30-110)					
160-10012-1	WAA-01-AF-PS-20141231	93.7					
160-10012-2	WAA-02-AF-PS-20141231	86.3					
160-10012-3	WAA-03-AF-PS-20141231	88.5					
160-10012-4	WAA-04-AF-PS-20141231	88.6					
160-10012-5	WAA-05-AF-PS-20141231	89.9					
160-10012-6	WAA-00-AF-FB-20141231	74.5					
LCS 160-168044/2-A	Lab Control Sample	92.3					
LCSD 160-168044/3-A	Lab Control Sample Dup	84.7					
MB 160-168044/1-A	Method Blank	99.8					
<b>Tracer/Carrier Legend</b>							
Th-229 = Thorium-229							

### Method: A-01-R - Isotopic Uranium (Alpha Spectrometry)

Matrix: Filter

Prep Type: Total/NA

		Percent Yield (Acceptance Limits)					
Lab Sample ID	Client Sample ID	U-232 (30-110)					
160-10012-1	WAA-01-AF-PS-20141231	82.1					
160-10012-2	WAA-02-AF-PS-20141231	83.7					
160-10012-3	WAA-03-AF-PS-20141231	80.5					
160-10012-4	WAA-04-AF-PS-20141231	86.2					
160-10012-5	WAA-05-AF-PS-20141231	81.2					
160-10012-6	WAA-00-AF-FB-20141231	79.5					
LCS 160-168045/2-A	Lab Control Sample	74.9					
LCSD 160-168045/3-A	Lab Control Sample Dup	76.5					
MB 160-168045/1-A	Method Blank	89.6					
<b>Tracer/Carrier Legend</b>							
U-232 = Uranium-232							

TestAmerica St. Louis

**Tetra Tech, Inc.**  
**DATA VALIDATION REPORT**  
**LEVEL II**

Site: West Lake Landfill Site, Bridgeton, Missouri

Laboratory: TestAmerica Laboratories, Inc. (Earth City, Missouri)

Data Reviewer: Harry Ellis, Tetra Tech, Inc. (Tetra Tech)

Review Date: February 25, 2015

Sample Delivery Group (SDG): J10012

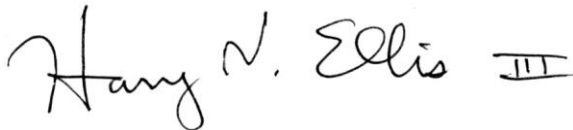
Sample Numbers: WAA-01-AF-PS-20141231, WAA-02-AF-PS-20141231, WAA-03-AF-PS-20141231, WAA-04-AF-PS-20141231, WAA-05-AF-PS-20141231, and WAA-00-AF-FB-20141231

Matrix / Number of Samples: 5 Air Samples and 1 Field Blank

The data were qualified according to the U.S. Environmental Protection Agency (EPA) Region 7 documents entitled "Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review" (9240.1-48), June 2008. In addition, the Tetra Tech document "Review of Data Packages from Subcontracted Laboratories" (February 2002) and the EPA and others document "Multi-Agency Radiological Laboratory Analytical Protocols Manual" (July 2004) were used along with other criteria specified in the applicable methods.

The review was intended to identify problems and quality control (QC) deficiencies that were readily apparent from the summary data package. The following sections discuss any problems or deficiencies that were found, and data qualifications applied because of non-compliant QC. The data review was limited to the available field and laboratory QC information submitted with the project-specific data package.

I, Harry Ellis, certify that all data validation criteria outlined in the above-referenced documents were assessed, and any qualifications made to the data accorded with those documents.



25 February 2015

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Certified by Harry Ellis, Chemist

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Date

## DATA VALIDATION QUALIFIERS

- U** — The analyte was not detected above the reported sample quantitation limit.
- J** — The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.
- UJ** — The analyte was not detected above the reported sample quantitation limit, which is estimated.
- R** — The sample results are rejected due to serious deficiencies in the ability to analyze the sample and meet QC criteria. Presence or absence of the analyte cannot be verified.



## **DATA ASSESSMENT**

Sample delivery group (SDG) J10012 included five (5) environmental air (filter) samples and one (1) QC samples (a field blank). Samples were analyzed for gross alpha and beta radiation by EPA SW-846 Method 9310 and for cesium-137 and other gamma-emitters by Department of Energy (DOE) Method Ga-01-R. The following summarizes the data validation that was performed.

### **RADIOANALYTICAL ANALYSES**

#### **I. Holding Time and Chain of Custody (COC) Requirements**

The samples were received by the laboratory and analyzed within the established holding time of 6 months from sample collection to analysis. No data were qualified.

#### **II. Matrix Spike/Matrix Spike Duplicate (MS/MSD)**

MS/MSD analyses are not practical for air analyses. LCS and duplicate sample analysis provided adequate data on precision and accuracy. No qualifications were applied.

#### **III. Blanks**

The laboratory (method) blank yielded a low gross beta activity and the field blank a somewhat higher beta activity. The other field samples yielded approximately 10 times the field blank beta activity, so no further qualifications were applied.

#### **IV. Laboratory Control Sample (LCS)**

All percent recoveries from the LCS analyses were within established control limits. No qualifications were applied.

#### **V. Surrogates**

Surrogates are not used in these radioanalytical methods.

#### **VI. Comments**

Some detected activities were less than their reporting limits ("RL"). These extrapolations should be qualified as estimated (flagged "J").

#### **VII. Overall Assessment of Data**

Overall data quality is acceptable, with no significant qualifications applied. All data are usable as qualified for their intended purposes.

# TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

## ANALYTICAL REPORT

TestAmerica Laboratories, Inc.

TestAmerica St. Louis  
13715 Rider Trail North  
Earth City, MO 63045  
Tel: (314)298-8566

TestAmerica Job ID: 160-10012-2

Client Project/Site: West Lake Landfill - Filters

For:

Tetra Tech EM Inc.  
415 Oak Street  
Kansas City, Missouri 64106

Attn: Ms. Emily Fisher

*Rhonda Ridenhower*

Authorized for release by:

1/15/2015 4:05:38 PM

Rhonda Ridenhower, Manager of Project Management  
[rhonda.ridenhower@testamericainc.com](mailto:rhonda.ridenhower@testamericainc.com)

Designee for

Erika Gish, Project Manager II  
(314)298-8566  
[erika.gish@testamericainc.com](mailto:erika.gish@testamericainc.com)

### LINKS

Review your project  
results through

TotalAccess

Have a Question?



Visit us at:

[www.testamericainc.com](http://www.testamericainc.com)

*This report has been electronically signed and authorized by the signatory. Electronic signature is intended to be the legally binding equivalent of a traditionally handwritten signature.*

*Results relate only to the items tested and the sample(s) as received by the laboratory.*

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## Case Narrative

Client: Tetra Tech EM Inc.  
Project/Site: West Lake Landfill - Filters

TestAmerica Job ID: 160-10012-2

**Job ID: 160-10012-2**

**Laboratory: TestAmerica St. Louis**

### Narrative

## CASE NARRATIVE

**Client: Tetra Tech EM Inc.**

**Project: West Lake Landfill - Filters**

**Report Number: 160-10012-2**

With the exceptions noted as flags or footnotes, standard analytical protocols were followed in the analysis of the samples and no problems were encountered or anomalies observed. In addition all laboratory quality control samples were within established control limits, with any exceptions noted below. Each sample was analyzed to achieve the lowest possible reporting limit within the constraints of the method. In some cases, due to interference or analytes present at high concentrations, samples were diluted. For diluted samples, the reporting limits are adjusted relative to the dilution required.

TestAmerica St. Louis attests to the validity of the laboratory data generated by TestAmerica facilities reported herein. All analyses performed by TestAmerica facilities were done using established laboratory SOPs that incorporate QA/QC procedures described in the application methods. TestAmerica's operations groups have reviewed the data for compliance with the laboratory QA/QC plan, and data have been found to be compliant with laboratory protocols unless otherwise noted below.

The test results in this report meet all NELAP requirements for parameters for which accreditation is required or available. Any exceptions to NELAP requirements are noted in this report. Pursuant to NELAP, this report may not be reproduced, except in full, without the written approval of the laboratory.

Calculations are performed before rounding to avoid round-off errors in calculated results.

All holding times were met and proper preservation noted for the methods performed on these samples, unless otherwise detailed in the individual sections below.

All solid sample results for Chemistry analyses are reported on an "as received" basis unless otherwise indicated by the presence of a % solids value in the method header. All soil/sediment sample results for radiochemistry analyses are based upon sample as dried and disaggregated with the exception of tritium, carbon-14, and iodine-129 by gamma spectroscopy unless requested as wet weight by the client."

This laboratory report is confidential and is intended for the sole use of TestAmerica and its client.

### RECEIPT

The samples were received on 01/05/2015; the samples arrived in good condition, properly preserved. The temperature of the coolers at receipt was 20.0 C.

### GROSS ALPHA AND GROSS BETA RADIOACTIVITY

Samples WAA-01-AF-PS-20141231 (160-10012-1), WAA-02-AF-PS-20141231 (160-10012-2), WAA-03-AF-PS-20141231 (160-10012-3), WAA-04-AF-PS-20141231 (160-10012-4), WAA-05-AF-PS-20141231 (160-10012-5) and WAA-00-AF-FB-20141231 (160-10012-6) were analyzed for Gross Alpha and Gross Beta Radioactivity in accordance with SW846 9310. The samples were prepared and analyzed on 01/07/2015.

No additional analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

### CESIUM 137 & OTHER GAMMA EMITTERS (GS)

Samples WAA-01-AF-PS-20141231 (160-10012-1), WAA-02-AF-PS-20141231 (160-10012-2), WAA-03-AF-PS-20141231 (160-10012-3), WAA-04-AF-PS-20141231 (160-10012-4), WAA-05-AF-PS-20141231 (160-10012-5) and WAA-00-AF-FB-20141231 (160-10012-6) were

## Case Narrative

Client: Tetra Tech EM Inc.  
Project/Site: West Lake Landfill - Filters

TestAmerica Job ID: 160-10012-2

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### Job ID: 160-10012-2 (Continued)

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#### Laboratory: TestAmerica St. Louis (Continued)

analyzed for Radium-226 & Other Gamma Emitters (GS) in accordance with GA-01-R. The samples were prepared and analyzed on 01/07/2015.

No additional analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

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## Chain of Custody Record

Regulatory Program: ☐ DW ☐ NPDES ☐ RCRA ☐ Other:

1520K

Client Contact		Project Manager: Dave Kinroth		Site Contact: Dave Kinroth		Date: 1-05-14		COC No:	
Tel/Fax: 314-517-6798		Tel/Fax: 314-517-6798		Lab Contact: Mike Franks		Carrier: NA		1 of 1 COCs	
Analysis Turnaround Time		Analysis Turnaround Time		Analysis Turnaround Time		Analysis Turnaround Time		Analysis Turnaround Time	
Tetra Tech, Inc.		Tetra Tech, Inc.		Tetra Tech, Inc.		Tetra Tech, Inc.		Tetra Tech, Inc.	
415 Oak Street		415 Oak Street		415 Oak Street		415 Oak Street		415 Oak Street	
Kansas City, MO 64106		Kansas City, MO 64106		Kansas City, MO 64106		Kansas City, MO 64106		Kansas City, MO 64106	
(816) 412-1786 Phone		(816) 412-1786 Phone		(816) 412-1786 Phone		(816) 412-1786 Phone		(816) 412-1786 Phone	
(816) 816-410-1748 FAX		(816) 816-410-1748 FAX		(816) 816-410-1748 FAX		(816) 816-410-1748 FAX		(816) 816-410-1748 FAX	
Project Name: West Lake Landfill Site		Project Name: West Lake Landfill Site		Project Name: West Lake Landfill Site		Project Name: West Lake Landfill Site		Project Name: West Lake Landfill Site	
Site: Bridgeton, MO		Site: Bridgeton, MO		Site: Bridgeton, MO		Site: Bridgeton, MO		Site: Bridgeton, MO	
P O # 1105610		P O # 1105610		P O # 1105610		P O # 1105610		P O # 1105610	
Sample Identification		Sample Identification		Sample Identification		Sample Identification		Sample Identification	
Sample Date		Sample Date		Sample Date		Sample Date		Sample Date	
Sample Time		Sample Time		Sample Time		Sample Time		Sample Time	
Sample Type (C=Comp, G=Grab)		Sample Type (C=Comp, G=Grab)		Sample Type (C=Comp, G=Grab)		Sample Type (C=Comp, G=Grab)		Sample Type (C=Comp, G=Grab)	
Matrix		Matrix		Matrix		Matrix		Matrix	
# of Cont.		# of Cont.		# of Cont.		# of Cont.		# of Cont.	
Filtered Sample (Y/N)		Filtered Sample (Y/N)		Filtered Sample (Y/N)		Filtered Sample (Y/N)		Filtered Sample (Y/N)	
Perform MS / MSD (Y / N)		Perform MS / MSD (Y / N)		Perform MS / MSD (Y / N)		Perform MS / MSD (Y / N)		Perform MS / MSD (Y / N)	
9310 Gross Alpha/Beta		9310 Gross Alpha/Beta		9310 Gross Alpha/Beta		9310 Gross Alpha/Beta		9310 Gross Alpha/Beta	
GA-01-R Gamm Spec		GA-01-R Gamm Spec		GA-01-R Gamm Spec		GA-01-R Gamm Spec		GA-01-R Gamm Spec	
9315 Total Alpha Radium		9315 Total Alpha Radium		9315 Total Alpha Radium		9315 Total Alpha Radium		9315 Total Alpha Radium	
A-01-R Isotopic Thorium		A-01-R Isotopic Thorium		A-01-R Isotopic Thorium		A-01-R Isotopic Thorium		A-01-R Isotopic Thorium	
A-01-R Isotopic Uranium		A-01-R Isotopic Uranium		A-01-R Isotopic Uranium		A-01-R Isotopic Uranium		A-01-R Isotopic Uranium	
* 9315 Radium-226 (GFPC)		* 9315 Radium-226 (GFPC)		* 9315 Radium-226 (GFPC)		* 9315 Radium-226 (GFPC)		* 9315 Radium-226 (GFPC)	
Sample Specific Notes:		Sample Specific Notes:		Sample Specific Notes:		Sample Specific Notes:		Sample Specific Notes:	
WAA-01-AF-PS-20141231		WAA-01-AF-PS-20141231		WAA-01-AF-PS-20141231		WAA-01-AF-PS-20141231		WAA-01-AF-PS-20141231	
WAA-02-AF-PS-20141231		WAA-02-AF-PS-20141231		WAA-02-AF-PS-20141231		WAA-02-AF-PS-20141231		WAA-02-AF-PS-20141231	
WAA-03-AF-PS-20141231		WAA-03-AF-PS-20141231		WAA-03-AF-PS-20141231		WAA-03-AF-PS-20141231		WAA-03-AF-PS-20141231	
WAA-04-AF-PS-20141231		WAA-04-AF-PS-20141231		WAA-04-AF-PS-20141231		WAA-04-AF-PS-20141231		WAA-04-AF-PS-20141231	
WAA-05-AF-PS-20141231		WAA-05-AF-PS-20141231		WAA-05-AF-PS-20141231		WAA-05-AF-PS-20141231		WAA-05-AF-PS-20141231	
WAA-00-AF-FB-20141231		WAA-00-AF-FB-20141231		WAA-00-AF-FB-20141231		WAA-00-AF-FB-20141231		WAA-00-AF-FB-20141231	
Preservation Used: 1= Ice, 2= HCL, 3= H2SO4, 4= HNO3, 5= NaOH, 6= Other		Preservation Used: 1= Ice, 2= HCL, 3= H2SO4, 4= HNO3, 5= NaOH, 6= Other		Preservation Used: 1= Ice, 2= HCL, 3= H2SO4, 4= HNO3, 5= NaOH, 6= Other		Preservation Used: 1= Ice, 2= HCL, 3= H2SO4, 4= HNO3, 5= NaOH, 6= Other		Preservation Used: 1= Ice, 2= HCL, 3= H2SO4, 4= HNO3, 5= NaOH, 6= Other	
Possible Hazard Identification:		Possible Hazard Identification:		Possible Hazard Identification:		Possible Hazard Identification:		Possible Hazard Identification:	
Are any samples from a listed EPA Hazardous Waste? Please List any EPA Waste Codes for the sample in the Comments Section if the lab is to dispose of the sample.		Are any samples from a listed EPA Hazardous Waste? Please List any EPA Waste Codes for the sample in the Comments Section if the lab is to dispose of the sample.		Are any samples from a listed EPA Hazardous Waste? Please List any EPA Waste Codes for the sample in the Comments Section if the lab is to dispose of the sample.		Are any samples from a listed EPA Hazardous Waste? Please List any EPA Waste Codes for the sample in the Comments Section if the lab is to dispose of the sample.		Are any samples from a listed EPA Hazardous Waste? Please List any EPA Waste Codes for the sample in the Comments Section if the lab is to dispose of the sample.	
<input checked="" type="checkbox"/> Non-Hazard		<input checked="" type="checkbox"/> Non-Hazard		<input checked="" type="checkbox"/> Non-Hazard		<input checked="" type="checkbox"/> Non-Hazard		<input checked="" type="checkbox"/> Non-Hazard	
<input type="checkbox"/> Flammable		<input type="checkbox"/> Flammable		<input type="checkbox"/> Flammable		<input type="checkbox"/> Flammable		<input type="checkbox"/> Flammable	
<input type="checkbox"/> Skin Irritant		<input type="checkbox"/> Skin Irritant		<input type="checkbox"/> Skin Irritant		<input type="checkbox"/> Skin Irritant		<input type="checkbox"/> Skin Irritant	
<input type="checkbox"/> Poison B		<input type="checkbox"/> Poison B		<input type="checkbox"/> Poison B		<input type="checkbox"/> Poison B		<input type="checkbox"/> Poison B	
<input type="checkbox"/> Unknown		<input type="checkbox"/> Unknown		<input type="checkbox"/> Unknown		<input type="checkbox"/> Unknown		<input type="checkbox"/> Unknown	
Sample Disposal ( A fee may be assessed if samples are retained longer than 1 month)		Sample Disposal ( A fee may be assessed if samples are retained longer than 1 month)		Sample Disposal ( A fee may be assessed if samples are retained longer than 1 month)		Sample Disposal ( A fee may be assessed if samples are retained longer than 1 month)		Sample Disposal ( A fee may be assessed if samples are retained longer than 1 month)	
<input type="checkbox"/> Return to Client		<input type="checkbox"/> Return to Client		<input type="checkbox"/> Return to Client		<input type="checkbox"/> Return to Client		<input type="checkbox"/> Return to Client	
<input type="checkbox"/> Disposal by Lab		<input type="checkbox"/> Disposal by Lab							

## Login Sample Receipt Checklist

Client: Tetra Tech EM Inc.

Job Number: 160-10012-2

Login Number: 10012

List Source: TestAmerica St. Louis

List Number: 1

Creator: Clarke, Jill C

Question	Answer	Comment
Radioactivity wasn't checked or is $\leq$ background as measured by a survey meter.	True	
The cooler's custody seal, if present, is intact.	N/A	
Sample custody seals, if present, are intact.	True	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	N/A	
Cooler Temperature is acceptable.	True	
Cooler Temperature is recorded.	True	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	N/A	
There are no discrepancies between the containers received and the COC.	True	
Samples are received within Holding Time.	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified.	True	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
Containers requiring zero headspace have no headspace or bubble is $<6\text{mm}$ (1/4").	N/A	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Residual Chlorine Checked.	N/A	

## Definitions/Glossary

Client: Tetra Tech EM Inc.  
Project/Site: West Lake Landfill - Filters

TestAmerica Job ID: 160-10012-2

### Qualifiers

#### Rad

Qualifier	Qualifier Description
U	Result is less than the sample detection limit.

### Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
α	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
CFL	Contains Free Liquid
CNF	Contains no Free Liquid
DER	Duplicate error ratio (normalized absolute difference)
Dil Fac	Dilution Factor
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision level concentration
MDA	Minimum detectable activity
EDL	Estimated Detection Limit
MDC	Minimum detectable concentration
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
NC	Not Calculated
ND	Not detected at the reporting limit (or MDL or EDL if shown)
PQL	Practical Quantitation Limit
QC	Quality Control
RER	Relative error ratio
RL	Reporting Limit or Requested Limit (Radiochemistry)
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)



## Method Summary

Client: Tetra Tech EM Inc.

TestAmerica Job ID: 160-10012-2

Project/Site: West Lake Landfill - Filters

Method	Method Description	Protocol	Laboratory
9310	Gross Alpha / Beta (GFPC)	SW846	TAL SL
GA-01-R	Cesium-137 & Other Gamma Emitters (GS)	DOE	TAL SL

### Protocol References:

DOE = U.S. Department of Energy

SW846 = "Test Methods For Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 And Its Updates.

### Laboratory References:

TAL SL = TestAmerica St. Louis, 13715 Rider Trail North, Earth City, MO 63045, TEL (314)298-8566

## Sample Summary

Client: Tetra Tech EM Inc.

TestAmerica Job ID: 160-10012-2

Project/Site: West Lake Landfill - Filters

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
160-10012-1	WAA-01-AF-PS-20141231	Filter	12/31/14 10:17	01/05/15 12:45
160-10012-2	WAA-02-AF-PS-20141231	Filter	12/31/14 10:33	01/05/15 12:45
160-10012-3	WAA-03-AF-PS-20141231	Filter	12/31/14 11:14	01/05/15 12:45
160-10012-4	WAA-04-AF-PS-20141231	Filter	12/31/14 11:30	01/05/15 12:45
160-10012-5	WAA-05-AF-PS-20141231	Filter	12/31/14 10:50	01/05/15 12:45
160-10012-6	WAA-00-AF-FB-20141231	Filter	12/31/14 00:00	01/05/15 12:45

# Client Sample Results

Client: Tetra Tech EM Inc.  
Project/Site: West Lake Landfill - Filters

TestAmerica Job ID: 160-10012-2

Client Sample ID: WAA-01-AF-PS-20141231

Lab Sample ID: 160-10012-1

Date Collected: 12/31/14 10:17

Matrix: Filter

Date Received: 01/05/15 12:45

## Method: 9310 - Gross Alpha / Beta (GFPC)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Gross Alpha	0.158	U	0.197	0.198	10.0	0.321	pCi/Sample	01/07/15 08:15	01/07/15 20:32	1
Gross Beta	15.8		1.11	1.94	10.0	0.399	pCi/Sample	01/07/15 08:15	01/07/15 20:32	1

## Method: GA-01-R - Cesium-137 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Cesium-137	0.0442	U	4.04	4.04	20.0	7.89	pCi/Sample	01/07/15 08:23	01/07/15 17:20	1

Other Detected Radionuclides	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Other Detected Radionuclide	None						pCi/Sample	01/07/15 08:23	01/07/15 17:20	1

Client Sample ID: WAA-02-AF-PS-20141231

Lab Sample ID: 160-10012-2

Date Collected: 12/31/14 10:33

Matrix: Filter

Date Received: 01/05/15 12:45

## Method: 9310 - Gross Alpha / Beta (GFPC)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Gross Alpha	0.527	J	0.287	0.293	10.0	0.326	pCi/Sample	01/07/15 08:15	01/07/15 20:33	1
Gross Beta	16.1		1.13	1.96	10.0	0.400	pCi/Sample	01/07/15 08:15	01/07/15 20:33	1

## Method: GA-01-R - Cesium-137 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Cesium-137	0.213	U	4.05	4.05	20.0	7.81	pCi/Sample	01/07/15 08:23	01/07/15 17:23	1

Other Detected Radionuclides	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Other Detected Radionuclide	None						pCi/Sample	01/07/15 08:23	01/07/15 17:23	1

Client Sample ID: WAA-03-AF-PS-20141231

Lab Sample ID: 160-10012-3

Date Collected: 12/31/14 11:14

Matrix: Filter

Date Received: 01/05/15 12:45

## Method: 9310 - Gross Alpha / Beta (GFPC)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Gross Alpha	0.251	U	0.214	0.215	10.0	0.302	pCi/Sample	01/07/15 08:15	01/07/15 21:47	1
Gross Beta	17.1		1.19	2.14	10.0	0.403	pCi/Sample	01/07/15 08:15	01/07/15 21:47	1

HUE 25 Febury 2015

TestAmerica St. Louis

# Client Sample Results

Client: Tetra Tech EM Inc.  
Project/Site: West Lake Landfill - Filters

TestAmerica Job ID: 160-10012-2

Client Sample ID: WAA-03-AF-PS-20141231

Lab Sample ID: 160-10012-3

Date Collected: 12/31/14 11:14

Matrix: Filter

Date Received: 01/05/15 12:45

## Method: GA-01-R - Cesium-137 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Cesium-137	1.75	U	4.37	4.37	20.0	7.75	pCi/Sample	01/07/15 08:23	01/07/15 17:21	1
<b>Other Detected</b>										
Radionuclides	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Other Detected Radionuclide	None						pCi/Sample	01/07/15 08:23	01/07/15 17:21	1

Client Sample ID: WAA-04-AF-PS-20141231

Lab Sample ID: 160-10012-4

Date Collected: 12/31/14 11:30

Matrix: Filter

Date Received: 01/05/15 12:45

## Method: 9310 - Gross Alpha / Beta (GFPC)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Gross Alpha	0.436	J	0.257	0.262	10.0	0.296	pCi/Sample	01/07/15 08:15	01/07/15 21:47	1
Gross Beta	16.3		1.15	1.99	10.0	0.405	pCi/Sample	01/07/15 08:15	01/07/15 21:47	1

## Method: GA-01-R - Cesium-137 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Cesium-137	-0.240	U	5.26	5.26	20.0	9.95	pCi/Sample	01/07/15 08:23	01/07/15 17:21	1
<b>Other Detected</b>										
Radionuclides	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Other Detected Radionuclide	None						pCi/Sample	01/07/15 08:23	01/07/15 17:21	1

Client Sample ID: WAA-05-AF-PS-20141231

Lab Sample ID: 160-10012-5

Date Collected: 12/31/14 10:50

Matrix: Filter

Date Received: 01/05/15 12:45

## Method: 9310 - Gross Alpha / Beta (GFPC)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Gross Alpha	0.392	J	0.257	0.261	10.0	0.321	pCi/Sample	01/07/15 08:15	01/07/15 21:47	1
Gross Beta	15.5		1.10	1.91	10.0	0.399	pCi/Sample	01/07/15 08:15	01/07/15 21:47	1

## Method: GA-01-R - Cesium-137 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Cesium-137	0.000	U	1.17	1.17	20.0	4.30	pCi/Sample	01/07/15 08:23	01/07/15 17:21	1

AUG 25 Feb 15

TestAmerica St. Louis

# Client Sample Results

Client: Tetra Tech EM Inc.  
Project/Site: West Lake Landfill - Filters

TestAmerica Job ID: 160-10012-2

Client Sample ID: WAA-05-AF-PS-20141231

Lab Sample ID: 160-10012-5

Date Collected: 12/31/14 10:50

Matrix: Filter

Date Received: 01/05/15 12:45

Other Detected	Count	Total							
Radionuclides	Uncert.	Uncert.							
Result	Qualifier	(2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac	
Other Detected	None				pCi/Sample	01/07/15 08:23	01/07/15 17:21	1	
Radionuclide									

Client Sample ID: WAA-00-AF-FB-20141231

Lab Sample ID: 160-10012-6

Date Collected: 12/31/14 00:00

Matrix: Filter

Date Received: 01/05/15 12:45

## Method: 9310 - Gross Alpha / Beta (GFPC)

Analyte	Result	Qualifier	Count	Total	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
			Uncert.	Uncert.						
			(2σ+/-)	(2σ+/-)						
Gross Alpha	0.207	U	0.213	0.214	10.0	0.328	pCi/Sample	01/07/15 08:15	01/07/15 21:47	1
Gross Beta	1.67	J	0.414	0.446	10.0	0.400	pCi/Sample	01/07/15 08:15	01/07/15 21:47	1

## Method: GA-01-R - Cesium-137 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count	Total	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
			Uncert.	Uncert.						
			(2σ+/-)	(2σ+/-)						
Cesium-137	-0.758	U	4.90	4.90	20.0	8.93	pCi/Sample	01/07/15 08:23	01/07/15 18:23	1

Other Detected	Count	Total							
Radionuclides	Uncert.	Uncert.							
Result	Qualifier	(2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac	
Other Detected	None				pCi/Sample	01/07/15 08:23	01/07/15 18:23	1	
Radionuclide									

HVE  
25 FEB 15

# QC Sample Results

Client: Tetra Tech EM Inc.  
Project/Site: West Lake Landfill - Filters

TestAmerica Job ID: 160-10012-2

## Method: 9310 - Gross Alpha / Beta (GFPC)

Lab Sample ID: MB 160-167105/1-A  
Matrix: Filter  
Analysis Batch: 167119

Client Sample ID: Method Blank  
Prep Type: Total/NA  
Prep Batch: 167105

Analyte	MB Result	MB Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Gross Alpha	0.2182	U	0.199	0.200	10.0	0.285	pCi/Sample	01/07/15 08:15	01/07/15 20:31	1
Gross Beta	0.4709		0.291	0.295	10.0	0.420	pCi/Sample	01/07/15 08:15	01/07/15 20:31	1

Lab Sample ID: LCS 160-167105/2-A  
Matrix: Filter  
Analysis Batch: 167119

Client Sample ID: Lab Control Sample  
Prep Type: Total/NA  
Prep Batch: 167105

Analyte	Spike Added	LCS Result	LCS Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits
Gross Alpha	5.37	5.275		0.987	10.0	0.302	pCi/Samp	98	75 - 125

Lab Sample ID: LCSB 160-167105/3-A  
Matrix: Filter  
Analysis Batch: 167119

Client Sample ID: Lab Control Sample  
Prep Type: Total/NA  
Prep Batch: 167105

Analyte	Spike Added	LCSB Result	LCSB Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits
Gross Beta	17.9	17.72		2.14	10.0	0.405	pCi/Samp	99	75 - 125

Lab Sample ID: 160-10012-1 DU  
Matrix: Filter  
Analysis Batch: 167119

Client Sample ID: WAA-01-AF-PS-20141231  
Prep Type: Total/NA  
Prep Batch: 167105

Analyte	Sample Result	Sample Qual	DU Result	DU Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	RER	RER Limit
Gross Alpha	0.158	U	0.6726		0.312	10.0	0.285	pCi/Samp	1.01	1
Gross Beta	15.8		15.97		1.96	10.0	0.420	pCi/Samp	0.03	1

## Method: GA-01-R - Cesium-137 & Other Gamma Emitters (GS)

Lab Sample ID: MB 160-167109/1-A  
Matrix: Filter  
Analysis Batch: 167314

Client Sample ID: Method Blank  
Prep Type: Total/NA  
Prep Batch: 167109

Analyte	MB Result	MB Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Cesium-137	-0.6458	U	8.98	8.98	20.0	15.7	pCi/Sample	01/07/15 08:23	01/07/15 17:23	1
Other Detected Radionuclides	MB Result	MB Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Other Detected Radionuclide	None						pCi/Sample	01/07/15 08:23	01/07/15 17:23	1

TestAmerica St. Louis

# QC Sample Results

Client: Tetra Tech EM Inc.  
Project/Site: West Lake Landfill - Filters

TestAmerica Job ID: 160-10012-2

## Method: GA-01-R - Cesium-137 & Other Gamma Emitters (GS) (Continued)

Lab Sample ID: LCS 160-167109/2-A  
Matrix: Filter  
Analysis Batch: 167316

Client Sample ID: Lab Control Sample  
Prep Type: Total/NA  
Prep Batch: 167109

Analyte	Spike Added	LCS Result	LCS Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits
Americium-241	32000	31440		3270		120	pCi/Samç	98	87 - 116
Cesium-137	11100	10860		1140	20.0	78.7	pCi/Samç	98	87 - 120
Cobalt-60	11800	11550		1170		39.1	pCi/Samç	98	87 - 115

Lab Sample ID: 160-10012-1 DU  
Matrix: Filter  
Analysis Batch: 167318

Client Sample ID: WAA-01-AF-PS-20141231  
Prep Type: Total/NA  
Prep Batch: 167109

Analyte	Sample Result	Sample Qual	DU Result	DU Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	RER	RER Limit
Cesium-137	0.0442	U	-1.423	U	6.18	20.0	11.3	pCi/Samç	0.14	1
Other Detected Radionuclides	Sample Result	Sample Qual	DU Result	DU Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	RER	RER Limit
Other Detected Radionuclide	None		None					pCi/Samç		

## QC Association Summary

Client: Tetra Tech EM Inc.  
Project/Site: West Lake Landfill - Filters

TestAmerica Job ID: 160-10012-2

### Rad

#### Prep Batch: 167105

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-10012-1	WAA-01-AF-PS-20141231	Total/NA	Filter	None	
160-10012-1 DU	WAA-01-AF-PS-20141231	Total/NA	Filter	None	
160-10012-2	WAA-02-AF-PS-20141231	Total/NA	Filter	None	
160-10012-3	WAA-03-AF-PS-20141231	Total/NA	Filter	None	
160-10012-4	WAA-04-AF-PS-20141231	Total/NA	Filter	None	
160-10012-5	WAA-05-AF-PS-20141231	Total/NA	Filter	None	
160-10012-6	WAA-00-AF-FB-20141231	Total/NA	Filter	None	
LCS 160-167105/2-A	Lab Control Sample	Total/NA	Filter	None	
LCSB 160-167105/3-A	Lab Control Sample	Total/NA	Filter	None	
MB 160-167105/1-A	Method Blank	Total/NA	Filter	None	

#### Prep Batch: 167109

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-10012-1	WAA-01-AF-PS-20141231	Total/NA	Filter	None	
160-10012-1 DU	WAA-01-AF-PS-20141231	Total/NA	Filter	None	
160-10012-2	WAA-02-AF-PS-20141231	Total/NA	Filter	None	
160-10012-3	WAA-03-AF-PS-20141231	Total/NA	Filter	None	
160-10012-4	WAA-04-AF-PS-20141231	Total/NA	Filter	None	
160-10012-5	WAA-05-AF-PS-20141231	Total/NA	Filter	None	
160-10012-6	WAA-00-AF-FB-20141231	Total/NA	Filter	None	
LCS 160-167109/2-A	Lab Control Sample	Total/NA	Filter	None	
MB 160-167109/1-A	Method Blank	Total/NA	Filter	None	



**Tetra Tech, Inc.**  
**DATA VALIDATION REPORT**  
**LEVEL II**

Site: West Lake Landfill Site, Bridgeton, Missouri

Laboratory: TestAmerica Laboratories, Inc. (Earth City, Missouri)

Data Reviewer: Harry Ellis, Tetra Tech, Inc. (Tetra Tech)

Review Date: February 25, 2015

Sample Delivery Group (SDG): J10086

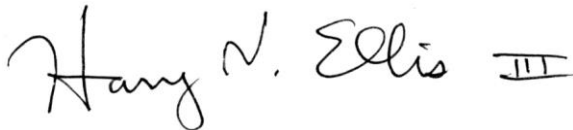
Sample Numbers: WAA-01-AF-PS-20150106, WAA-02-AF-PS-20150106, WAA-03-AF-PS-20150106, WAA-04-AF-PS-20150106, WAA-05-AF-PS-20150106, and WAA-00-AF-FB-20150106

Matrix / Number of Samples: 5 Air Samples and 1 Field Blank

The data were qualified according to the U.S. Environmental Protection Agency (EPA) Region 7 documents entitled "Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review" (9240.1-48), June 2008. In addition, the Tetra Tech document "Review of Data Packages from Subcontracted Laboratories" (February 2002) and the EPA and others document "Multi-Agency Radiological Laboratory Analytical Protocols Manual" (July 2004) were used along with other criteria specified in the applicable methods.

The review was intended to identify problems and quality control (QC) deficiencies that were readily apparent from the summary data package. The following sections discuss any problems or deficiencies that were found, and data qualifications applied because of non-compliant QC. The data review was limited to the available field and laboratory QC information submitted with the project-specific data package.

I, Harry Ellis, certify that all data validation criteria outlined in the above-referenced documents were assessed, and any qualifications made to the data accorded with those documents.



25 February 2015

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Certified by Harry Ellis, Chemist

---

Date

## DATA VALIDATION QUALIFIERS

- U** — The analyte was not detected above the reported sample quantitation limit.
- J** — The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.
- UJ** — The analyte was not detected above the reported sample quantitation limit, which is estimated.
- R** — The sample results are rejected due to serious deficiencies in the ability to analyze the sample and meet QC criteria. Presence or absence of the analyte cannot be verified.

## **DATA ASSESSMENT**

Sample delivery group (SDG) J10086 included five (5) environmental air (filter) samples and one (1) QC sample (a field blank). Samples were analyzed for total alpha-emitting radium by EPA SW-846 Method 9315 and for isotopic (alpha-emitting) thorium and uranium by Department of Energy (DOE) Method A-01-R. The following summarizes the data validation that was performed.

### **RADIOANALYTICAL ANALYSES**

#### **I. Holding Time and Chain of Custody (COC) Requirements**

The samples were received by the laboratory and analyzed within the established holding time of 6 months from sample collection to analysis. No data were qualified.

#### **II. Matrix Spike/Matrix Spike Duplicate (MS/MSD)**

Insufficient sample was available for MS/MSD analyses. Duplicate LCS analysis provided adequate data on precision and accuracy. No qualifications were applied.

#### **III. Blanks**

The laboratory (method) blank yielded low activities for one (of three) thorium isotopes and for one (of three) uranium isotopes, while the field blank yielded low activities for two thorium isotopes and one uranium isotopes. No qualifications were applied.

#### **IV. Laboratory Control Sample (LCS)**

All percent recoveries and relative percent differences from the duplicate LCS analyses were within established control limits.

#### **V. Surrogates**

These radioanalytical methods use a “carrier” or “tracer”, whose recovery serves the same functions as surrogate recoveries. All carrier and tracer recoveries were within the laboratory’s QC limits. No qualifications were applied.

#### **VI. Comments**

All detected results were less than their reporting limits (“RL”). These extrapolations should be qualified as estimated (flagged “J”).

#### **VII. Overall Assessment of Data**

Overall data quality is acceptable, with few qualifications applied. All data are usable as qualified for their intended purposes.

# TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

## ANALYTICAL REPORT

TestAmerica Laboratories, Inc.

TestAmerica St. Louis  
13715 Rider Trail North  
Earth City, MO 63045  
Tel: (314)298-8566

TestAmerica Job ID: 160-10086-1

Client Project/Site: West Lake Landfill - Filters

For:

Tetra Tech EM Inc.  
415 Oak Street  
Kansas City, Missouri 64106

Attn: Ms. Emily Fisher



Authorized for release by:  
1/29/2015 1:24:51 PM

Erika Gish, Project Manager II  
(314)298-8566  
[erika.gish@testamericainc.com](mailto:erika.gish@testamericainc.com)

### LINKS

Review your project  
results through

TotalAccess

Have a Question?



Visit us at:

[www.testamericainc.com](http://www.testamericainc.com)

*This report has been electronically signed and authorized by the signatory. Electronic signature is intended to be the legally binding equivalent of a traditionally handwritten signature.*

*Results relate only to the items tested and the sample(s) as received by the laboratory.*

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## Case Narrative

Client: Tetra Tech EM Inc.  
Project/Site: West Lake Landfill - Filters

TestAmerica Job ID: 160-10086-1

**Job ID: 160-10086-1**

**Laboratory: TestAmerica St. Louis**

### Narrative

#### CASE NARRATIVE

**Client: Tetra Tech EM Inc.**

**Project: West Lake Landfill - Filters**

**Report Number: 160-10086-1**

With the exceptions noted as flags or footnotes, standard analytical protocols were followed in the analysis of the samples and no problems were encountered or anomalies observed. In addition all laboratory quality control samples were within established control limits, with any exceptions noted below. Each sample was analyzed to achieve the lowest possible reporting limit within the constraints of the method. In some cases, due to interference or analytes present at high concentrations, samples were diluted. For diluted samples, the reporting limits are adjusted relative to the dilution required.

TestAmerica St. Louis attests to the validity of the laboratory data generated by TestAmerica facilities reported herein. All analyses performed by TestAmerica facilities were done using established laboratory SOPs that incorporate QA/QC procedures described in the application methods. TestAmerica's operations groups have reviewed the data for compliance with the laboratory QA/QC plan, and data have been found to be compliant with laboratory protocols unless otherwise noted below.

The test results in this report meet all NELAP requirements for parameters for which accreditation is required or available. Any exceptions to NELAP requirements are noted in this report. Pursuant to NELAP, this report may not be reproduced, except in full, without the written approval of the laboratory.

Calculations are performed before rounding to avoid round-off errors in calculated results.

All holding times were met and proper preservation noted for the methods performed on these samples, unless otherwise detailed in the individual sections below.

All solid sample results for Chemistry analyses are reported on an "as received" basis unless otherwise indicated by the presence of a % solids value in the method header. All soil/sediment sample results for radiochemistry analyses are based upon sample as dried and disaggregated with the exception of tritium, carbon-14, and iodine-129 by gamma spectroscopy unless requested as wet weight by the client."

This laboratory report is confidential and is intended for the sole use of TestAmerica and its client.

#### RECEIPT

The samples were received on 01/12/2015; the samples arrived in good condition, properly preserved and on ice. The temperature of the coolers at receipt was 20.0 C.

#### TOTAL ALPHA RADIUM (GFPC)

Samples WAA-01-AF-PS-20150106 (160-10086-1), WAA-02-AF-PS-20150106 (160-10086-2), WAA-03-AF-PS-20150106 (160-10086-3), WAA-04-AF-PS-20150106 (160-10086-4), WAA-05-AF-PS-20150106 (160-10086-5) and WAA-00-AF-FB-20150106 (160-10086-6) were analyzed for Total Alpha Radium (GFPC) in accordance with SW- 846 Method 9315. The samples were prepared on 01/21/2015 and analyzed on 01/26/2015 and 01/27/2015.

No analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

#### ISOTOPIC THORIUM (ALPHA SPECTROMETRY)

Samples WAA-01-AF-PS-20150106 (160-10086-1), WAA-02-AF-PS-20150106 (160-10086-2), WAA-03-AF-PS-20150106 (160-10086-3), WAA-04-AF-PS-20150106 (160-10086-4), WAA-05-AF-PS-20150106 (160-10086-5) and WAA-00-AF-FB-20150106 (160-10086-6) were

## Case Narrative

Client: Tetra Tech EM Inc.  
Project/Site: West Lake Landfill - Filters

TestAmerica Job ID: 160-10086-1

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### Job ID: 160-10086-1 (Continued)

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#### Laboratory: TestAmerica St. Louis (Continued)

analyzed for Isotopic Thorium (Alpha Spectrometry) in accordance with A-01-R. The samples were prepared on 01/19/2015 and analyzed on 01/26/2015.

No additional analytical or quality issues were noted, other than those described in the Definitions/Glossary page.

#### ISOTOPIC URANIUM (ALPHA SPECTROMETRY)

Samples WAA-01-AF-PS-20150106 (160-10086-1), WAA-02-AF-PS-20150106 (160-10086-2), WAA-03-AF-PS-20150106 (160-10086-3), WAA-04-AF-PS-20150106 (160-10086-4), WAA-05-AF-PS-20150106 (160-10086-5) and WAA-00-AF-FB-20150106 (160-10086-6) were analyzed for Isotopic Uranium (Alpha Spectrometry) in accordance with A-01-R. The samples were prepared on 01/19/2015 and analyzed on 01/23/2015.

No additional analytical or quality issues were noted, other than those described in the Definitions/Glossary page.

13715 Rider Trail North

Earth City, MO 63045  
phone 314.298.8566 fax

## Chain of Custody Record

# TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

**TestAmerica Laboratories, Inc.**

Regulatory Program: ☐ DW ☐ NPDES ☐ RCRA ☐ Other:[illegible]



## Login Sample Receipt Checklist

Client: Tetra Tech EM Inc.

Job Number: 160-10086-1

Login Number: 10086

List Source: TestAmerica St. Louis

List Number: 1

Creator: Daniels, Brian J

Question	Answer	Comment
Radioactivity wasn't checked or is $\leq$ background as measured by a survey meter.	True	
The cooler's custody seal, if present, is intact.	N/A	
Sample custody seals, if present, are intact.	N/A	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	N/A	
Cooler Temperature is acceptable.	True	
Cooler Temperature is recorded.	True	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	N/A	
There are no discrepancies between the containers received and the COC.	True	
Samples are received within Holding Time.	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified.	True	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
Containers requiring zero headspace have no headspace or bubble is $<6\text{mm}$ (1/4").	N/A	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Residual Chlorine Checked.	N/A	

## Definitions/Glossary

Client: Tetra Tech EM Inc.  
Project/Site: West Lake Landfill - Filters

TestAmerica Job ID: 160-10086-1

### Qualifiers

#### Rad

Qualifier	Qualifier Description
U	Result is less than the sample detection limit.

### Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
α	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
CFL	Contains Free Liquid
CNF	Contains no Free Liquid
DER	Duplicate error ratio (normalized absolute difference)
Dil Fac	Dilution Factor
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision level concentration
MDA	Minimum detectable activity
EDL	Estimated Detection Limit
MDC	Minimum detectable concentration
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
NC	Not Calculated
ND	Not detected at the reporting limit (or MDL or EDL if shown)
PQL	Practical Quantitation Limit
QC	Quality Control
RER	Relative error ratio
RL	Reporting Limit or Requested Limit (Radiochemistry)
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)

## Method Summary

Client: Tetra Tech EM Inc.  
Project/Site: West Lake Landfill - Filters

TestAmerica Job ID: 160-10086-1

Method	Method Description	Protocol	Laboratory
9315	Total Alpha Radium (GFPC)	SW846	TAL SL
A-01-R	Isotopic Thorium (Alpha Spectrometry)	DOE	TAL SL
A-01-R	Isotopic Uranium (Alpha Spectrometry)	DOE	TAL SL

### Protocol References:

DOE = U.S. Department of Energy

SW846 = "Test Methods For Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 And Its Updates.

### Laboratory References:

TAL SL = TestAmerica St. Louis, 13715 Rider Trail North, Earth City, MO 63045, TEL (314)298-8566

## Sample Summary

Client: Tetra Tech EM Inc.

TestAmerica Job ID: 160-10086-1

Project/Site: West Lake Landfill - Filters

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
160-10086-1	WAA-01-AF-PS-20150106	Filter	01/06/15 14:28	01/12/15 15:15
160-10086-2	WAA-02-AF-PS-20150106	Filter	01/06/15 14:45	01/12/15 15:15
160-10086-3	WAA-03-AF-PS-20150106	Filter	01/06/15 15:15	01/12/15 15:15
160-10086-4	WAA-04-AF-PS-20150106	Filter	01/06/15 15:30	01/12/15 15:15
160-10086-5	WAA-05-AF-PS-20150106	Filter	01/06/15 15:00	01/12/15 15:15
160-10086-6	WAA-00-AF-FB-20150106	Filter	01/06/15 00:00	01/12/15 15:15

# Client Sample Results

Client: Tetra Tech EM Inc.  
Project/Site: West Lake Landfill - Filters

TestAmerica Job ID: 160-10086-1

Client Sample ID: WAA-01-AF-PS-20150106

Lab Sample ID: 160-10086-1

Date Collected: 01/06/15 14:28

Matrix: Filter

Date Received: 01/12/15 15:15

## Method: 9315 - Total Alpha Radium (GFPC)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Total Alpha Radium	0.498	U	0.470	0.472	1.00	0.732	pCi/Sample	01/21/15 09:46	01/26/15 20:08	1
Carrier	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Ba Carrier	101		40 - 110					01/21/15 09:46	01/26/15 20:08	1

## Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	-0.00666	U	0.127	0.127	1.00	0.268	pCi/Sample	01/19/15 14:10	01/26/15 08:53	1
Thorium-230	0.315	J	0.161	0.164	1.00	0.138	pCi/Sample	01/19/15 14:10	01/26/15 08:53	1
Thorium-232	0.0186	U	0.0373	0.0373	1.00	0.0559	pCi/Sample	01/19/15 14:10	01/26/15 08:53	1
Tracer	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Thorium-229	92.5		30 - 110					01/19/15 14:10	01/26/15 08:53	1

## Method: A-01-R - Isotopic Uranium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Uranium-233/234	0.182	J	0.128	0.129	1.00	0.131	pCi/Sample	01/19/15 14:10	01/23/15 11:28	1
Uranium-235/236	0.0247	U	0.0495	0.0495	1.00	0.0742	pCi/Sample	01/19/15 14:10	01/23/15 11:28	1
Uranium-238	0.0198	U	0.0397	0.0397	1.00	0.0595	pCi/Sample	01/19/15 14:10	01/23/15 11:28	1
Tracer	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Uranium-232	86.1		30 - 110					01/19/15 14:10	01/23/15 11:28	1

Client Sample ID: WAA-02-AF-PS-20150106

Lab Sample ID: 160-10086-2

Date Collected: 01/06/15 14:45

Matrix: Filter

Date Received: 01/12/15 15:15

## Method: 9315 - Total Alpha Radium (GFPC)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Total Alpha Radium	0.220	U	0.427	0.428	1.00	0.758	pCi/Sample	01/21/15 09:46	01/26/15 20:08	1
Carrier	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Ba Carrier	98.5		40 - 110					01/21/15 09:46	01/26/15 20:08	1

## Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.0531	U	0.166	0.166	1.00	0.330	pCi/Sample	01/19/15 14:10	01/26/15 08:53	1
Thorium-230	0.561	J	0.264	0.268	1.00	0.166	pCi/Sample	01/19/15 14:10	01/26/15 08:53	1
Thorium-232	0.000	U	0.0249	0.0249	1.00	0.0897	pCi/Sample	01/19/15 14:10	01/26/15 08:53	1

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TestAmerica St. Louis

# Client Sample Results

Client: Tetra Tech EM Inc.  
Project/Site: West Lake Landfill - Filters

TestAmerica Job ID: 160-10086-1

Client Sample ID: WAA-02-AF-PS-20150106

Lab Sample ID: 160-10086-2

Date Collected: 01/06/15 14:45

Matrix: Filter

Date Received: 01/12/15 15:15

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	58.7		30 - 110	01/19/15 14:10	01/26/15 08:53	1

## Method: A-01-R - Isotopic Uranium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Uranium-233/234	0.0910	U	0.0904	0.0907	1.00	0.110	pCi/Sample	01/19/15 14:10	01/23/15 11:28	1
Uranium-235/236	0.0494	U	0.0699	0.0700	1.00	0.0742	pCi/Sample	01/19/15 14:10	01/23/15 11:28	1
Uranium-238	0.0991	J	0.0887	0.0890	1.00	0.0595	pCi/Sample	01/19/15 14:10	01/23/15 11:28	1

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Uranium-232	85.2		30 - 110	01/19/15 14:10	01/23/15 11:28	1

Client Sample ID: WAA-03-AF-PS-20150106

Lab Sample ID: 160-10086-3

Date Collected: 01/06/15 15:15

Matrix: Filter

Date Received: 01/12/15 15:15

## Method: 9315 - Total Alpha Radium (GFPC)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Total Alpha Radium	0.0271	U	0.464	0.464	1.00	0.889	pCi/Sample	01/21/15 09:46	01/26/15 20:08	1

Carrier	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Ba Carrier	101		40 - 110	01/21/15 09:46	01/26/15 20:08	1

## Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.216	J	0.161	0.162	1.00	0.207	pCi/Sample	01/19/15 14:10	01/26/15 08:53	1
Thorium-230	0.448	J	0.196	0.200	1.00	0.0842	pCi/Sample	01/19/15 14:10	01/26/15 08:53	1
Thorium-232	0.0248	U	0.0653	0.0653	1.00	0.140	pCi/Sample	01/19/15 14:10	01/26/15 08:53	1

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	81.9		30 - 110	01/19/15 14:10	01/26/15 08:53	1

## Method: A-01-R - Isotopic Uranium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Uranium-233/234	0.126	J	0.103	0.103	1.00	0.106	pCi/Sample	01/19/15 14:10	01/23/15 11:28	1
Uranium-235/236	0.0139	U	0.0517	0.0517	1.00	0.132	pCi/Sample	01/19/15 14:10	01/23/15 11:28	1
Uranium-238	0.0606	U	0.0799	0.0800	1.00	0.126	pCi/Sample	01/19/15 14:10	01/23/15 11:28	1

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Uranium-232	91.9		30 - 110	01/19/15 14:10	01/23/15 11:28	1

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TestAmerica St. Louis

# Client Sample Results

Client Tetra Tech EM Inc.  
Project/Site: West Lake Landfill - Filters

TestAmerica Job ID: 160-10086-1

Client Sample ID: WAA-04-AF-PS-20150106

Lab Sample ID: 160-10086-4

Date Collected: 01/06/15 15:30

Matrix: Filter

Date Received: 01/12/15 15:15

## Method: 9315 - Total Alpha Radium (GFPC)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Total Alpha Radium	0.900	J	0.599	0.605	1.00	0.882	pCi/Sample	01/21/15 09:46	01/27/15 07:04	1
Carrier	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Ba Carrier	97.1		40 - 110					01/21/15 09:46	01/27/15 07:04	1

## Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.0347	U	0.129	0.129	1.00	0.254	pCi/Sample	01/19/15 14:10	01/26/15 08:53	1
Thorium-230	0.354	J	0.176	0.178	1.00	0.147	pCi/Sample	01/19/15 14:10	01/26/15 08:53	1
Thorium-232	0.0708	U	0.0808	0.0810	1.00	0.109	pCi/Sample	01/19/15 14:10	01/26/15 08:53	1
Tracer	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Thorium-229	86.1		30 - 110					01/19/15 14:10	01/26/15 08:53	1

## Method: A-01-R - Isotopic Uranium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Uranium-233/234	0.113	U	0.0997	0.100	1.00	0.121	pCi/Sample	01/19/15 14:10	01/23/15 11:28	1
Uranium-235/236	0.0362	U	0.0675	0.0676	1.00	0.127	pCi/Sample	01/19/15 14:10	01/23/15 11:28	1
Uranium-238	0.0444	U	0.110	0.110	1.00	0.209	pCi/Sample	01/19/15 14:10	01/23/15 11:28	1
Tracer	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Uranium-232	94.8		30 - 110					01/19/15 14:10	01/23/15 11:28	1

Client Sample ID: WAA-05-AF-PS-20150106

Lab Sample ID: 160-10086-5

Date Collected: 01/06/15 15:00

Matrix: Filter

Date Received: 01/12/15 15:15

## Method: 9315 - Total Alpha Radium (GFPC)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Total Alpha Radium	0.465	U	0.524	0.525	1.00	0.856	pCi/Sample	01/21/15 09:46	01/27/15 07:04	1
Carrier	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Ba Carrier	99.4		40 - 110					01/21/15 09:46	01/27/15 07:04	1

## Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.0139	U	0.115	0.115	1.00	0.237	pCi/Sample	01/19/15 14:10	01/26/15 08:53	1
Thorium-230	0.242	J	0.154	0.155	1.00	0.180	pCi/Sample	01/19/15 14:10	01/26/15 08:53	1
Thorium-232	0.00308	U	0.0429	0.0429	1.00	0.122	pCi/Sample	01/19/15 14:10	01/26/15 08:53	1
Tracer	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Thorium-229	92.1		30 - 110					01/19/15 14:10	01/26/15 08:53	1

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# Client Sample Results

Client: Tetra Tech EM Inc.  
Project/Site: West Lake Landfill - Filters

TestAmerica Job ID: 160-10086-1

Client Sample ID: WAA-05-AF-PS-20150106

Lab Sample ID: 160-10086-5

Date Collected: 01/06/15 15:00

Matrix: Filter

Date Received: 01/12/15 15:15

## Method: A-01-R - Isotopic Uranium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Uranium-233/234	0.0960	U	0.103	0.103	1.00	0.149	pCi/Sample	01/19/15 14:10	01/23/15 11:28	1
Uranium-235/236	0.0398	U	0.0741	0.0742	1.00	0.139	pCi/Sample	01/19/15 14:10	01/23/15 11:28	1
Uranium-238	-0.0151	U	0.0861	0.0861	1.00	0.213	pCi/Sample	01/19/15 14:10	01/23/15 11:28	1
Tracer	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Uranium-232	87.6		30 - 110					01/19/15 14:10	01/23/15 11:28	1

Client Sample ID: WAA-00-AF-FB-20150106

Lab Sample ID: 160-10086-6

Date Collected: 01/06/15 00:00

Matrix: Filter

Date Received: 01/12/15 15:15

## Method: 9315 - Total Alpha Radium (GFPC)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Total Alpha Radium	-0.219	U	0.456	0.457	1.00	0.958	pCi/Sample	01/21/15 09:46	01/27/15 07:04	1
Carrier	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Ba Carrier	98.5		40 - 110					01/21/15 09:46	01/27/15 07:04	1

## Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.108	U	0.123	0.124	1.00	0.195	pCi/Sample	01/19/15 14:10	01/26/15 08:53	1
Thorium-230	0.256	J	0.143	0.145	1.00	0.106	pCi/Sample	01/19/15 14:10	01/26/15 08:53	1
Thorium-232	0.0574	J	0.0663	0.0664	1.00	0.0574	pCi/Sample	01/19/15 14:10	01/26/15 08:53	1
Tracer	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Thorium-229	88.0		30 - 110					01/19/15 14:10	01/26/15 08:53	1

## Method: A-01-R - Isotopic Uranium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Uranium-233/234	0.0400	U	0.0676	0.0677	1.00	0.121	pCi/Sample	01/19/15 14:10	01/23/15 11:28	1
Uranium-235/236	0.0230	U	0.0460	0.0460	1.00	0.0690	pCi/Sample	01/19/15 14:10	01/23/15 11:28	1
Uranium-238	0.140	J	0.105	0.106	1.00	0.102	pCi/Sample	01/19/15 14:10	01/23/15 11:28	1
Tracer	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Uranium-232	95.3		30 - 110					01/19/15 14:10	01/23/15 11:28	1

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# QC Sample Results

Client: Tetra Tech EM Inc.  
Project/Site: West Lake Landfill - Filters

TestAmerica Job ID: 160-10086-1

## Method: 9315 - Total Apha Radium (GFPC)

Lab Sample ID: MB 160-169561/1-A

Matrix: Filter

Analysis Batch: 170161

Client Sample ID: Method Blank

Prep Type: Total/NA

Prep Batch: 169561

Analyte	MB Result	MB Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Total Alpha Radium	0.5100	U	0.578	0.580	1.00	0.944	pCi/Sample	01/21/15 09:46	01/26/15 20:08	1
Carrier	MB %Yield	MB Qualifier	Limits					Prepared	Analyzed	Dil Fac
Ba Carrier	95.9		40 - 110					01/21/15 09:46	01/26/15 20:08	1

Lab Sample ID: LCS 160-169561/2-A

Matrix: Filter

Analysis Batch: 170161

Client Sample ID: Lab Control Sample

Prep Type: Total/NA

Prep Batch: 169561

Analyte	Spike Added	LCS Result	LCS Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits	
Total Alpha Radium	45.0	44.35		5.03	1.00	1.20	pCi/Samp	99	65 - 150	
Carrier	LCS %Yield	LCS Qualifier	Limits							
Ba Carrier	85.3		40 - 110							

Lab Sample ID: LCSD 160-169561/3-A

Matrix: Filter

Analysis Batch: 170161

Client Sample ID: Lab Control Sample Dup

Prep Type: Total/NA

Prep Batch: 169561

Analyte	Spike Added	LCSD Result	LCSD Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits	RER	RER Limit
Total Alpha Radium	45.0	49.15		5.38	1.00	0.899	pCi/Samp	109	65 - 150	0.46	1
Carrier	LCSD %Yield	LCSD Qualifier	Limits								
Ba Carrier	95.3		40 - 110								

## Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Lab Sample ID: MB 160-169196/1-A

Matrix: Filter

Analysis Batch: 170442

Client Sample ID: Method Blank

Prep Type: Total/NA

Prep Batch: 169196

Analyte	MB Result	MB Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.07470	U	0.100	0.100	1.00	0.165	pCi/Sample	01/19/15 14:10	01/26/15 08:53	1
Thorium-230	0.4838		0.201	0.205	1.00	0.154	pCi/Sample	01/19/15 14:10	01/26/15 08:53	1
Thorium-232	-0.007912	U	0.0158	0.0158	1.00	0.105	pCi/Sample	01/19/15 14:10	01/26/15 08:53	1
Tracer	MB %Yield	MB Qualifier	Limits					Prepared	Analyzed	Dil Fac
Thorium-229	89.9		30 - 110					01/19/15 14:10	01/26/15 08:53	1

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# QC Sample Results

Client: Tetra Tech EM Inc.  
Project/Site: West Lake Landfill - Filters

TestAmerica Job ID: 160-10086-1

## Method: A-01-R - Isotopic Thorium (Alpha Spectrometry) (Continued)

Lab Sample ID: LCS 160-169196/2-A

Matrix: Filter

Analysis Batch: 170468

Client Sample ID: Lab Control Sample

Prep Type: Total/NA

Prep Batch: 169196

Analyte	Spike Added	LCS Result	LCS Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits
Thorium-230	16.1	15.51		1.68	1.00	0.165	pCi/Samp	97	81 - 118
Tracer	LCS %Yield	LCS Qualifier	Limits						
Thorium-229	97.8		30 - 110						

Lab Sample ID: LCSD 160-169196/3-A

Matrix: Filter

Analysis Batch: 170469

Client Sample ID: Lab Control Sample Dup

Prep Type: Total/NA

Prep Batch: 169196

Analyte	Spike Added	LCSD Result	LCSD Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits	RER	RER Limit
Thorium-230	16.1	18.94		2.07	1.00	0.188	pCi/Samp	118	81 - 118	0.91	1
Tracer	LCSD %Yield	LCSD Qualifier	Limits								
Thorium-229	71.7		30 - 110								

## Method: A-01-R - Isotopic Uranium (Alpha Spectrometry)

Lab Sample ID: MB 160-169197/1-A

Matrix: Filter

Analysis Batch: 170109

Client Sample ID: Method Blank

Prep Type: Total/NA

Prep Batch: 169197

Analyte	MB Result	MB Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Uranium-233/234	0.08414		0.0841	0.0844	1.00	0.0631	pCi/Sample	01/19/15 14:10	01/23/15 11:28	1
Uranium-235/236	0.0000	U	0.0218	0.0218	1.00	0.0785	pCi/Sample	01/19/15 14:10	01/23/15 11:28	1
Uranium-238	0.06298	U	0.0727	0.0729	1.00	0.0630	pCi/Sample	01/19/15 14:10	01/23/15 11:28	1
Tracer	MB %Yield	MB Qualifier	Limits			Prepared	Analyzed	Dil Fac		
Uranium-232	82.7		30 - 110			01/19/15 14:10	01/23/15 11:28	1		

Lab Sample ID: LCS 160-169197/2-A

Matrix: Filter

Analysis Batch: 170110

Client Sample ID: Lab Control Sample

Prep Type: Total/NA

Prep Batch: 169197

Analyte	Spike Added	LCS Result	LCS Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits
Uranium-233/234	25.5	27.81		2.81	1.00	0.161	pCi/Samp	109	84 - 120
Uranium-238	26.0	29.63		2.96	1.00	0.121	pCi/Samp	114	82 - 122
Tracer	LCS %Yield	LCS Qualifier	Limits						
Uranium-232	78.4		30 - 110						

TestAmerica St. Louis

# QC Sample Results

Client: Tetra Tech EM Inc.  
Project/Site: West Lake Landfill - Filters

TestAmerica Job ID: 160-10086-1

## Method: A-01-R - Isotopic Uranium (Alpha Spectrometry) (Continued)

Lab Sample ID: LCSD 160-169197/3-A

Matrix: Filter

Analysis Batch: 170111

Client Sample ID: Lab Control Sample Dup

Prep Type: Total/NA

Prep Batch: 169197

Analyte	Spike Added	LCSD Result	LCSD Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits	RER	RER Limit
Uranium-233/234	25.5	23.34		2.39	1.00	0.0600	pCi/Samp	92	84 - 120	0.86	1
Uranium-238	26.0	25.61		2.58	1.00	0.0599	pCi/Samp	98	82 - 122	0.72	1

Tracer	LCSD %Yield	LCSD Qualifier	Limits
Uranium-232	85.8		30 - 110

# QC Association Summary

Client: Tetra Tech EM Inc.  
Project/Site: West Lake Landfill - Filters

TestAmerica Job ID: 160-10086-1

## Rad

### Prep Batch: 169196

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-10086-1	WAA-01-AF-PS-20150106	Total/NA	Filter	ExtChrom	
160-10086-2	WAA-02-AF-PS-20150106	Total/NA	Filter	ExtChrom	
160-10086-3	WAA-03-AF-PS-20150106	Total/NA	Filter	ExtChrom	
160-10086-4	WAA-04-AF-PS-20150106	Total/NA	Filter	ExtChrom	
160-10086-5	WAA-05-AF-PS-20150106	Total/NA	Filter	ExtChrom	
160-10086-6	WAA-00-AF-FB-20150106	Total/NA	Filter	ExtChrom	
LCS 160-169196/2-A	Lab Control Sample	Total/NA	Filter	ExtChrom	
LCSD 160-169196/3-A	Lab Control Sample Dup	Total/NA	Filter	ExtChrom	
MB 160-169196/1-A	Method Blank	Total/NA	Filter	ExtChrom	

### Prep Batch: 169197

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-10086-1	WAA-01-AF-PS-20150106	Total/NA	Filter	ExtChrom	
160-10086-2	WAA-02-AF-PS-20150106	Total/NA	Filter	ExtChrom	
160-10086-3	WAA-03-AF-PS-20150106	Total/NA	Filter	ExtChrom	
160-10086-4	WAA-04-AF-PS-20150106	Total/NA	Filter	ExtChrom	
160-10086-5	WAA-05-AF-PS-20150106	Total/NA	Filter	ExtChrom	
160-10086-6	WAA-00-AF-FB-20150106	Total/NA	Filter	ExtChrom	
LCS 160-169197/2-A	Lab Control Sample	Total/NA	Filter	ExtChrom	
LCSD 160-169197/3-A	Lab Control Sample Dup	Total/NA	Filter	ExtChrom	
MB 160-169197/1-A	Method Blank	Total/NA	Filter	ExtChrom	

### Prep Batch: 169561

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-10086-1	WAA-01-AF-PS-20150106	Total/NA	Filter	DPS-0	
160-10086-2	WAA-02-AF-PS-20150106	Total/NA	Filter	DPS-0	
160-10086-3	WAA-03-AF-PS-20150106	Total/NA	Filter	DPS-0	
160-10086-4	WAA-04-AF-PS-20150106	Total/NA	Filter	DPS-0	
160-10086-5	WAA-05-AF-PS-20150106	Total/NA	Filter	DPS-0	
160-10086-6	WAA-00-AF-FB-20150106	Total/NA	Filter	DPS-0	
LCS 160-169561/2-A	Lab Control Sample	Total/NA	Filter	DPS-0	
LCSD 160-169561/3-A	Lab Control Sample Dup	Total/NA	Filter	DPS-0	
MB 160-169561/1-A	Method Blank	Total/NA	Filter	DPS-0	

## Tracer/Carrier Summary

Client: Tetra Tech EM Inc.  
Project/Site: West Lake Landfill - Filters

TestAmerica Job ID: 160-10086-1

### Method: 9315 - Total Apha Radium (GFPC)

Matrix: Filter

Prep Type: Total/NA

		Percent Yield (Acceptance Limits)					
Lab Sample ID	Client Sample ID	Ba (40-110)					
160-10086-1	WAA-01-AF-PS-20150106	101					
160-10086-2	WAA-02-AF-PS-20150106	98.5					
160-10086-3	WAA-03-AF-PS-20150106	101					
160-10086-4	WAA-04-AF-PS-20150106	97.1					
160-10086-5	WAA-05-AF-PS-20150106	99.4					
160-10086-6	WAA-00-AF-FB-20150106	98.5					
LCS 160-169561/2-A	Lab Control Sample	85.3					
LCSD 160-169561/3-A	Lab Control Sample Dup	95.3					
MB 160-169561/1-A	Method Blank	95.9					
<b>Tracer/Carrier Legend</b>							
Ba = Ba Carrier							

### Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Matrix: Filter

Prep Type: Total/NA

		Percent Yield (Acceptance Limits)					
Lab Sample ID	Client Sample ID	Th-229 (30-110)					
160-10086-1	WAA-01-AF-PS-20150106	92.5					
160-10086-2	WAA-02-AF-PS-20150106	58.7					
160-10086-3	WAA-03-AF-PS-20150106	81.9					
160-10086-4	WAA-04-AF-PS-20150106	86.1					
160-10086-5	WAA-05-AF-PS-20150106	92.1					
160-10086-6	WAA-00-AF-FB-20150106	88.0					
LCS 160-169196/2-A	Lab Control Sample	97.8					
LCSD 160-169196/3-A	Lab Control Sample Dup	71.7					
MB 160-169196/1-A	Method Blank	89.9					
<b>Tracer/Carrier Legend</b>							
Th-229 = Thorium-229							

### Method: A-01-R - Isotopic Uranium (Alpha Spectrometry)

Matrix: Filter

Prep Type: Total/NA

		Percent Yield (Acceptance Limits)					
Lab Sample ID	Client Sample ID	U-232 (30-110)					
160-10086-1	WAA-01-AF-PS-20150106	86.1					
160-10086-2	WAA-02-AF-PS-20150106	85.2					
160-10086-3	WAA-03-AF-PS-20150106	91.9					
160-10086-4	WAA-04-AF-PS-20150106	94.8					
160-10086-5	WAA-05-AF-PS-20150106	87.6					
160-10086-6	WAA-00-AF-FB-20150106	95.3					
LCS 160-169197/2-A	Lab Control Sample	78.4					
LCSD 160-169197/3-A	Lab Control Sample Dup	85.8					
MB 160-169197/1-A	Method Blank	82.7					
<b>Tracer/Carrier Legend</b>							
U-232 = Uranium-232							

TestAmerica St. Louis

**Tetra Tech, Inc.**  
**DATA VALIDATION REPORT**  
**LEVEL II**

Site: West Lake Landfill Site, Bridgeton, Missouri

Laboratory: TestAmerica Laboratories, Inc. (Earth City, Missouri)

Data Reviewer: Harry Ellis, Tetra Tech, Inc. (Tetra Tech)

Review Date: February 25, 2015

Sample Delivery Group (SDG): J10086

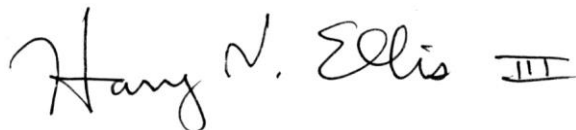
Sample Numbers: WAA-01-AF-PS-20150106, WAA-02-AF-PS-20150106, WAA-03-AF-PS-20150106, WAA-04-AF-PS-20150106, WAA-05-AF-PS-20150106, and WAA-00-AF-FB-20150106

Matrix / Number of Samples: 5 Air Samples and 1 Field Blank

The data were qualified according to the U.S. Environmental Protection Agency (EPA) Region 7 documents entitled "Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review" (9240.1-48), June 2008. In addition, the Tetra Tech document "Review of Data Packages from Subcontracted Laboratories" (February 2002) and the EPA and others document "Multi-Agency Radiological Laboratory Analytical Protocols Manual" (July 2004) were used along with other criteria specified in the applicable methods.

The review was intended to identify problems and quality control (QC) deficiencies that were readily apparent from the summary data package. The following sections discuss any problems or deficiencies that were found, and data qualifications applied because of non-compliant QC. The data review was limited to the available field and laboratory QC information submitted with the project-specific data package.

I, Harry Ellis, certify that all data validation criteria outlined in the above-referenced documents were assessed, and any qualifications made to the data accorded with those documents.



25 February 2015

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Certified by Harry Ellis, Chemist

---

Date

## DATA VALIDATION QUALIFIERS

- U** — The analyte was not detected above the reported sample quantitation limit.
- J** — The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.
- UJ** — The analyte was not detected above the reported sample quantitation limit, which is estimated.
- R** — The sample results are rejected due to serious deficiencies in the ability to analyze the sample and meet QC criteria. Presence or absence of the analyte cannot be verified.

## **DATA ASSESSMENT**

Sample delivery group (SDG) J10086 included five (5) environmental air (filter) samples and one (1) QC samples (a field blank). Samples were analyzed for gross alpha and beta radiation by EPA SW-846 Method 9310 and for cesium-137 and other gamma-emitters by Department of Energy (DOE) Method Ga-01-R. The following summarizes the data validation that was performed.

### **RADIOANALYTICAL ANALYSES**

#### **I. Holding Time and Chain of Custody (COC) Requirements**

The samples were received by the laboratory and analyzed within the established holding time of 6 months from sample collection to analysis. No data were qualified.

#### **II. Matrix Spike/Matrix Spike Duplicate (MS/MSD)**

MS/MSD analyses are not practical for air analyses. LCS and duplicate sample analysis provided adequate data on precision and accuracy. No qualifications were applied.

#### **III. Blanks**

The laboratory (method) blank yielded a low gross beta activity and the field blank a somewhat higher beta activity. The other field samples yielded approximately 10 times the field blank beta activity, so no further qualifications were applied.

#### **IV. Laboratory Control Sample (LCS)**

All percent recoveries from the LCS analyses were within established control limits. No qualifications were applied.

#### **V. Surrogates**

Surrogates are not used in these radioanalytical methods.

#### **VI. Comments**

Some detected activities were less than their reporting limits ("RL"). These extrapolations should be qualified as estimated (flagged "J").

#### **VII. Overall Assessment of Data**

Overall data quality is acceptable, with no significant qualifications applied. All data are usable as qualified for their intended purposes.



# TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

## ANALYTICAL REPORT

TestAmerica Laboratories, Inc.

TestAmerica St. Louis  
13715 Rider Trail North  
Earth City, MO 63045  
Tel: (314)298-8566

TestAmerica Job ID: 160-10086-2

Client Project/Site: West Lake Landfill - Filters

For:

Tetra Tech EM Inc.  
415 Oak Street  
Kansas City, Missouri 64106

Attn: Ms. Emily Fisher



Authorized for release by:  
1/20/2015 10:39:54 AM

Erika Gish, Project Manager II  
(314)298-8566  
[erika.gish@testamericainc.com](mailto:erika.gish@testamericainc.com)

### LINKS

Review your project  
results through

TotalAccess

Have a Question?



Visit us at:

[www.testamericainc.com](http://www.testamericainc.com)

*This report has been electronically signed and authorized by the signatory. Electronic signature is intended to be the legally binding equivalent of a traditionally handwritten signature.*

*Results relate only to the items tested and the sample(s) as received by the laboratory.*

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## Case Narrative

Client: Tetra Tech EM Inc.  
Project/Site: West Lake Landfill - Filters

TestAmerica Job ID: 160-10086-2

**Job ID: 160-10086-2**

**Laboratory: TestAmerica St. Louis**

### Narrative

#### CASE NARRATIVE

**Client: Tetra Tech EM Inc.**

**Project: West Lake Landfill - Filters**

**Report Number: 160-10086-2**

With the exceptions noted as flags or footnotes, standard analytical protocols were followed in the analysis of the samples and no problems were encountered or anomalies observed. In addition all laboratory quality control samples were within established control limits, with any exceptions noted below. Each sample was analyzed to achieve the lowest possible reporting limit within the constraints of the method. In some cases, due to interference or analytes present at high concentrations, samples were diluted. For diluted samples, the reporting limits are adjusted relative to the dilution required.

TestAmerica St. Louis attests to the validity of the laboratory data generated by TestAmerica facilities reported herein. All analyses performed by TestAmerica facilities were done using established laboratory SOPs that incorporate QA/QC procedures described in the application methods. TestAmerica's operations groups have reviewed the data for compliance with the laboratory QA/QC plan, and data have been found to be compliant with laboratory protocols unless otherwise noted below.

The test results in this report meet all NELAP requirements for parameters for which accreditation is required or available. Any exceptions to NELAP requirements are noted in this report. Pursuant to NELAP, this report may not be reproduced, except in full, without the written approval of the laboratory.

Calculations are performed before rounding to avoid round-off errors in calculated results.

All holding times were met and proper preservation noted for the methods performed on these samples, unless otherwise detailed in the individual sections below.

All solid sample results for Chemistry analyses are reported on an "as received" basis unless otherwise indicated by the presence of a % solids value in the method header. All soil/sediment sample results for radiochemistry analyses are based upon sample as dried and disaggregated with the exception of tritium, carbon-14, and iodine-129 by gamma spectroscopy unless requested as wet weight by the client."

This laboratory report is confidential and is intended for the sole use of TestAmerica and its client.

#### RECEIPT

The samples were received on 1/12/2015 3:15 PM; the samples arrived in good condition, properly preserved. The temperature of the cooler at receipt was 20.0° C.

#### GROSS ALPHA AND GROSS BETA RADIOACTIVITY

Samples WAA-01-AF-PS-20150106 (160-10086-1), WAA-02-AF-PS-20150106 (160-10086-2), WAA-03-AF-PS-20150106 (160-10086-3), WAA-04-AF-PS-20150106 (160-10086-4), WAA-05-AF-PS-20150106 (160-10086-5) and WAA-00-AF-FB-20150106 (160-10086-6) were analyzed for Gross Alpha and Gross Beta Radioactivity in accordance with SW846 9310. The samples were prepared on 01/15/2015 and analyzed on 01/16/2015.

No analytical or quality issues were noted, other than those described in the Definitions/Glossary page.

#### RADIUM-226 & OTHER GAMMA EMITTERS (GS)

Samples WAA-01-AF-PS-20150106 (160-10086-1), WAA-02-AF-PS-20150106 (160-10086-2), WAA-03-AF-PS-20150106 (160-10086-3), WAA-04-AF-PS-20150106 (160-10086-4), WAA-05-AF-PS-20150106 (160-10086-5) and WAA-00-AF-FB-20150106 (160-10086-6) were

## Case Narrative

Client: Tetra Tech EM Inc.  
Project/Site: West Lake Landfill - Filters

TestAmerica Job ID: 160-10086-2

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### Job ID: 160-10086-2 (Continued)

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#### Laboratory: TestAmerica St. Louis (Continued)

analyzed for Radium-226 & Other Gamma Emitters (GS) in accordance with GA-01-R. The samples were prepared on 01/15/2015 and analyzed on 01/16/2015 and 01/18/2015.

No analytical or quality issues were noted, other than those described in the Definitions/Glossary page.

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## Chain of Custody Record

Regulatory Program: ☐ DW ☐ NPDES ☐ RCRA ☐ Other:

TestAmerica Laboratories, Inc.

<b>Client Contact</b>		<b>Project Manager: Dave Kinroth</b>		<b>Site Contact: Dave Kinroth</b>		<b>Date: 1-12-15</b>		<b>COC No:</b>	
Tetra Tech, Inc.		Tel/Fax: 314-517-6798		Lab Contact: Mike Franks		Carrier: NA		1 of 1 COCs	
415 Oak Street		<b>Analysis Turnaround Time</b>		Filtered Sample (Y/N) Perform MS / MSD (Y / N) 9310 Gross Alpha/Beta GA-01-R Gamma Spec 9315 Total Alpha Radium A-01-R Isotopic Thorium A-01-R Isotopic Uranium * 9315 Radium-226 (GFPC)		<input type="checkbox"/> CALENDAR DAYS <input checked="" type="checkbox"/> WORKING DAYS TAT if different from Below 20 <input type="checkbox"/> 2 weeks <input type="checkbox"/> 1 week <input type="checkbox"/> 2 days <input type="checkbox"/> 1 day		Sampler:	
Kansas City, MO 64106		Phone						For Lab Use Only:	
(816) 412-1786		(816) 816-410-1748 FAX						Walk-in Client:	
Project Name: West Lake Landfill Site		Site: Bridgeton, MO						Lab Sampling:	
P O # 1105610						Job / SDG No.:			
<b>Sample Identification</b>		<b>Sample Date</b>	<b>Sample Time</b>	<b>Sample Type (C=Comp, G=Grab)</b>	<b>Matrix</b>	<b># of Cont.</b>			<b>Sample Specific Notes:</b>
WAA-01-AF-PS-20150106	1/6/15	14:28	Filter	Air	1		X	X	* 9315 Radium-226 (GFPC)
WAA-02-AF-PS-20150106	1/6/15	14:45	Filter	Air	1		X	X	contingent upon TAR results
WAA-03-AF-PS-20150106	1/6/15	15:15	Filter	Air	1		X	X	for all samples
WAA-04-AF-PS-20150106	1/6/15	15:30	Filter	Air	1		X	X	
WAA-05-AF-PS-20150106	1/6/15	15:00	Filter	Air	1		X	X	
WAA-00-AF-FB-20150106	1/6/15	NA	Filter	Air	1		X	X	
 160-10086 Chain of Custody									
Preservation Used: 1= Ice, 2= HCl, 3= H2SO4, 4= HNO3, 5= NaOH, 6= Other									
<b>Possible Hazard Identification:</b> Are any samples from a listed EPA Hazardous Waste? Please List any EPA Waste Codes for the sample in the Comments Section if the lab is to dispose of the sample.						<b>Sample Disposal ( A fee may be assessed if samples are retained longer than 1 month)</b>			
<input checked="" type="checkbox"/> Non-Hazard <input type="checkbox"/> Flammable <input type="checkbox"/> Skin Irritant <input type="checkbox"/> Poison B <input type="checkbox"/> Unknown						<input type="checkbox"/> Return to Client <input type="checkbox"/> Disposal by Lab <input type="checkbox"/> Archive for _____ Months			
<b>Special Instructions/QC Requirements &amp; Comments:</b>									
Custody Seals Intact: <input type="checkbox"/> Yes <input type="checkbox"/> No		Custody Seal No.:		Cooler Temp. (°C): Obs'd: _____		Corr'd: _____		Therm ID No.:	
Relinquished by: <i>Tony Bore</i>		Company: Tetra Tech		Date/Time: 1/12/15 1515		Received by: <i>[Signature]</i>		Company: M-2-L	
Relinquished by:		Company:		Date/Time:		Received by:		Company:	
Relinquished by:		Company:		Date/Time:		Received in Laboratory by:		Company:	

## Login Sample Receipt Checklist

Client: Tetra Tech EM Inc.

Job Number: 160-10086-2

Login Number: 10086

List Source: TestAmerica St. Louis

List Number: 1

Creator: Daniels, Brian J

Question	Answer	Comment
Radioactivity wasn't checked or is $\leq$ background as measured by a survey meter.	True	
The cooler's custody seal, if present, is intact.	N/A	
Sample custody seals, if present, are intact.	N/A	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	N/A	
Cooler Temperature is acceptable.	True	
Cooler Temperature is recorded.	True	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	N/A	
There are no discrepancies between the containers received and the COC.	True	
Samples are received within Holding Time.	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified.	True	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
Containers requiring zero headspace have no headspace or bubble is $<6\text{mm}$ (1/4").	N/A	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Residual Chlorine Checked.	N/A	

## Definitions/Glossary

Client: Tetra Tech EM Inc.  
Project/Site: West Lake Landfill - Filters

TestAmerica Job ID: 160-10086-2

### Qualifiers

#### Rad

Qualifier	Qualifier Description
U	Result is less than the sample detection limit.

### Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
α	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
CFL	Contains Free Liquid
CNF	Contains no Free Liquid
DER	Duplicate error ratio (normalized absolute difference)
Dil Fac	Dilution Factor
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision level concentration
MDA	Minimum detectable activity
EDL	Estimated Detection Limit
MDC	Minimum detectable concentration
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
NC	Not Calculated
ND	Not detected at the reporting limit (or MDL or EDL if shown)
PQL	Practical Quantitation Limit
QC	Quality Control
RER	Relative error ratio
RL	Reporting Limit or Requested Limit (Radiochemistry)
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)

## Method Summary

Client: Tetra Tech EM Inc.  
Project/Site: West Lake Landfill - Filters

TestAmerica Job ID: 160-10086-2

Method	Method Description	Protocol	Laboratory
9310	Gross Alpha / Beta (GFPC)	SW846	TAL SL
GA-01-R	Cesium-137 & Other Gamma Emitters (GS)	DOE	TAL SL

### Protocol References:

DOE = U.S. Department of Energy

SW846 = "Test Methods For Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 And Its Updates.

### Laboratory References:

TAL SL = TestAmerica St. Louis, 13715 Rider Trail North, Earth City, MO 63045, TEL (314)298-8566



## Sample Summary

Client: Tetra Tech EM Inc.

TestAmerica Job ID: 160-10086-2

Project/Site: West Lake Landfill - Filters

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
160-10086-1	WAA-01-AF-PS-20150106	Filter	01/06/15 14:28	01/12/15 15:15
160-10086-2	WAA-02-AF-PS-20150106	Filter	01/06/15 14:45	01/12/15 15:15
160-10086-3	WAA-03-AF-PS-20150106	Filter	01/06/15 15:15	01/12/15 15:15
160-10086-4	WAA-04-AF-PS-20150106	Filter	01/06/15 15:30	01/12/15 15:15
160-10086-5	WAA-05-AF-PS-20150106	Filter	01/06/15 15:00	01/12/15 15:15
160-10086-6	WAA-00-AF-FB-20150106	Filter	01/06/15 00:00	01/12/15 15:15

# Client Sample Results

Client: Tetra Tech EM Inc.  
Project/Site: West Lake Landfill - Filters

TestAmerica Job ID: 160-10086-2

Client Sample ID: WAA-01-AF-PS-20150106

Lab Sample ID: 160-10086-1

Date Collected: 01/06/15 14:28

Matrix: Filter

Date Received: 01/12/15 15:15

## Method: 9310 - Gross Alpha / Beta (GFPC)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Gross Alpha	0.489	J	0.304	0.310	10.0	0.385	pCi/Sample	01/15/15 14:36	01/16/15 09:28	1
Gross Beta	12.3		0.979	1.57	10.0	0.371	pCi/Sample	01/15/15 14:36	01/16/15 09:28	1

## Method: GA-01-R - Cesium-137 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Cesium-137	0.794	U	5.87	5.87	20.0	10.8	pCi/Sample	01/15/15 14:46	01/16/15 12:47	1

Other Detected Radionuclides	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Other Detected Radionuclide	None						pCi/Sample	01/15/15 14:46	01/16/15 12:47	1

Client Sample ID: WAA-02-AF-PS-20150106

Lab Sample ID: 160-10086-2

Date Collected: 01/06/15 14:45

Matrix: Filter

Date Received: 01/12/15 15:15

## Method: 9310 - Gross Alpha / Beta (GFPC)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Gross Alpha	0.513	J	0.282	0.288	10.0	0.329	pCi/Sample	01/15/15 14:36	01/16/15 09:28	1
Gross Beta	12.4		1.00	1.59	10.0	0.423	pCi/Sample	01/15/15 14:36	01/16/15 09:28	1

## Method: GA-01-R - Cesium-137 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Cesium-137	-1.21	U	6.19	6.19	20.0	11.4	pCi/Sample	01/15/15 14:46	01/16/15 12:48	1

Other Detected Radionuclides	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Other Detected Radionuclide	None						pCi/Sample	01/15/15 14:46	01/16/15 12:48	1

Client Sample ID: WAA-03-AF-PS-20150106

Lab Sample ID: 160-10086-3

Date Collected: 01/06/15 15:15

Matrix: Filter

Date Received: 01/12/15 15:15

## Method: 9310 - Gross Alpha / Beta (GFPC)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Gross Alpha	0.424	J	0.284	0.288	10.0	0.384	pCi/Sample	01/15/15 14:36	01/16/15 09:28	1
Gross Beta	16.9		1.16	2.05	10.0	0.412	pCi/Sample	01/15/15 14:36	01/16/15 09:28	1

HVE 25 February 2015

TestAmerica St. Louis

# Client Sample Results

Client: Tetra Tech EM Inc.  
Project/Site: West Lake Landfill - Filters

TestAmerica Job ID: 160-10086-2

Client Sample ID: WAA-03-AF-PS-20150106

Lab Sample ID: 160-10086-3

Date Collected: 01/06/15 15:15

Matrix: Filter

Date Received: 01/12/15 15:15

## Method: GA-01-R - Cesium-137 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Cesium-137	-2.72	U	14.8	14.8	20.0	14.2	pCi/Sample	01/15/15 14:46	01/16/15 12:52	1
Other Detected										
Radionuclides	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Other Detected Radionuclide	None						pCi/Sample	01/15/15 14:46	01/16/15 12:52	1

Client Sample ID: WAA-04-AF-PS-20150106

Lab Sample ID: 160-10086-4

Date Collected: 01/06/15 15:30

Matrix: Filter

Date Received: 01/12/15 15:15

## Method: 9310 - Gross Alpha / Beta (GFPC)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Gross Alpha	0.770	J	0.325	0.336	10.0	0.316	pCi/Sample	01/15/15 14:36	01/16/15 09:29	1
Gross Beta	16.8		1.11	1.93	10.0	0.354	pCi/Sample	01/15/15 14:36	01/16/15 09:29	1

## Method: GA-01-R - Cesium-137 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Cesium-137	0.864	U	4.67	4.67	20.0	8.64	pCi/Sample	01/15/15 14:46	01/16/15 12:51	1
Other Detected										
Radionuclides	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Other Detected Radionuclide	None						pCi/Sample	01/15/15 14:46	01/16/15 12:51	1

Client Sample ID: WAA-05-AF-PS-20150106

Lab Sample ID: 160-10086-5

Date Collected: 01/06/15 15:00

Matrix: Filter

Date Received: 01/12/15 15:15

## Method: 9310 - Gross Alpha / Beta (GFPC)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Gross Alpha	0.584	J	0.277	0.285	10.0	0.272	pCi/Sample	01/15/15 14:36	01/16/15 09:29	1
Gross Beta	15.0		1.07	1.84	10.0	0.333	pCi/Sample	01/15/15 14:36	01/16/15 09:29	1

## Method: GA-01-R - Cesium-137 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Cesium-137	-2.77	U	17.1	17.1	20.0	14.9	pCi/Sample	01/15/15 14:46	01/16/15 12:50	1

HUE 25 Feb 15

TestAmerica St. Louis

# Client Sample Results

Client: Tetra Tech EM Inc.  
Project/Site: West Lake Landfill - Filters

TestAmerica Job ID: 160-10086-2

Client Sample ID: WAA-05-AF-PS-20150106

Lab Sample ID: 160-10086-5

Date Collected: 01/06/15 15:00

Matrix: Filter

Date Received: 01/12/15 15:15

Other Detected		Count		Total						
Radionuclides	Result	Qualifier	Uncert.	Uncert.	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Other Detected	None		(2σ+/-)	(2σ+/-)			pCi/Sample	01/15/15 14:46	01/16/15 12:50	1
Radionuclide										

Client Sample ID: WAA-00-AF-FB-20150106

Lab Sample ID: 160-10086-6

Date Collected: 01/06/15 00:00

Matrix: Filter

Date Received: 01/12/15 15:15

Method: 9310 - Gross Alpha / Beta (GFPC)

		Count		Total						
Analyte	Result	Qualifier	Uncert.	Uncert.	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Gross Alpha	0.274	U	(2σ+/-)	(2σ+/-)	10.0	0.281	pCi/Sample	01/15/15 14:36	01/16/15 09:29	1
Gross Beta	1.64	J	(2σ+/-)	(2σ+/-)	10.0	0.350	pCi/Sample	01/15/15 14:36	01/16/15 09:29	1

Method: GA-01-R - Cesium-137 & Other Gamma Emitters (GS)

		Count		Total						
Analyte	Result	Qualifier	Uncert.	Uncert.	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Cesium-137	2.58	U	(2σ+/-)	(2σ+/-)	20.0	11.1	pCi/Sample	01/15/15 14:46	01/18/15 21:30	1
Other Detected		Count		Total						
Radionuclides	Result	Qualifier	Uncert.	Uncert.	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Other Detected	None		(2σ+/-)	(2σ+/-)			pCi/Sample	01/15/15 14:46	01/18/15 21:30	1
Radionuclide										

HUG  
25 Feb 15

# QC Sample Results

Client: Tetra Tech EM Inc.  
Project/Site: West Lake Landfill - Filters

TestAmerica Job ID: 160-10086-2

## Method: 9310 - Gross Alpha / Beta (GFPC)

Lab Sample ID: MB 160-168591/1-A

Matrix: Filter

Analysis Batch: 168922

Client Sample ID: Method Blank

Prep Type: Total/NA

Prep Batch: 168591

Analyte	MB Result	MB Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Gross Alpha	0.4390		0.270	0.275	10.0	0.338	pCi/Sample	01/15/15 14:36	01/16/15 09:28	1
Gross Beta	0.2601	U	0.221	0.223	10.0	0.338	pCi/Sample	01/15/15 14:36	01/16/15 09:28	1

Lab Sample ID: LCS 160-168591/2-A

Matrix: Filter

Analysis Batch: 168922

Client Sample ID: Lab Control Sample

Prep Type: Total/NA

Prep Batch: 168591

Analyte	Spike Added	LCS Result	LCS Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits
Gross Alpha	5.37	5.452		1.02	10.0	0.380	pCi/Samp	102	75 - 125

Lab Sample ID: LCSB 160-168591/3-A

Matrix: Filter

Analysis Batch: 168922

Client Sample ID: Lab Control Sample

Prep Type: Total/NA

Prep Batch: 168591

Analyte	Spike Added	LCSB Result	LCSB Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits
Gross Beta	17.9	18.08		2.16	10.0	0.357	pCi/Samp	101	75 - 125

Lab Sample ID: 160-10086-1 DU

Matrix: Filter

Analysis Batch: 168922

Client Sample ID: WAA-01-AF-PS-20150106

Prep Type: Total/NA

Prep Batch: 168591

Analyte	Sample Result	Sample Qual	DU Result	DU Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	RER	RER Limit
Gross Alpha	0.489		1.025		0.390	10.0	0.338	pCi/Samp	0.77	1
Gross Beta	12.3		11.01		1.45	10.0	0.338	pCi/Samp	0.42	1

## Method: GA-01-R - Cesium-137 & Other Gamma Emitters (GS)

Lab Sample ID: MB 160-168592/1-A

Matrix: Filter

Analysis Batch: 168955

Client Sample ID: Method Blank

Prep Type: Total/NA

Prep Batch: 168592

Analyte	MB Result	MB Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Cesium-137	-0.2938	U	5.22	5.22	20.0	9.65	pCi/Sample	01/15/15 14:46	01/16/15 12:48	1
Other Detected Radionuclides	MB Result	MB Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Other Detected Radionuclide	None						pCi/Sample	01/15/15 14:46	01/16/15 12:48	1

TestAmerica St. Louis

# QC Sample Results

Client: Tetra Tech EM Inc.  
Project/Site: West Lake Landfill - Filters

TestAmerica Job ID: 160-10086-2

## Method: GA-01-R - Cesium-137 & Other Gamma Emitters (GS) (Continued)

Lab Sample ID: LCS 160-168592/2-A  
Matrix: Filter  
Analysis Batch: 168956

Client Sample ID: Lab Control Sample  
Prep Type: Total/NA  
Prep Batch: 168592

Analyte	Spike Added	LCS Result	LCS Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits
Americium-241	32000	31300		3250		100	pCi/Samp	98	87 - 116
Cesium-137	11100	11170		1170	20.0	54.5	pCi/Samp	101	87 - 120
Cobalt-60	11800	11780		1190		40.8	pCi/Samp	100	87 - 115

Lab Sample ID: 160-10086-1 DU  
Matrix: Filter  
Analysis Batch: 168955

Client Sample ID: WAA-01-AF-PS-20150106  
Prep Type: Total/NA  
Prep Batch: 168592

Analyte	Sample Result	Sample Qual	DU Result	DU Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	RER	RER Limit
Cesium-137	0.794	U	-0.6050	U	5.08	20.0	9.34	pCi/Samp	0.13	1
Other Detected Radionuclides	Sample Result	Sample Qual	DU Result	DU Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	RER	RER Limit
Other Detected Radionuclide	None		None					pCi/Samp		

## QC Association Summary

Client: Tetra Tech EM Inc.  
Project/Site: West Lake Landfill - Filters

TestAmerica Job ID: 160-10086-2

### Rad

#### Prep Batch: 168591

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-10086-1	WAA-01-AF-PS-20150106	Total/NA	Filter	None	
160-10086-1 DU	WAA-01-AF-PS-20150106	Total/NA	Filter	None	
160-10086-2	WAA-02-AF-PS-20150106	Total/NA	Filter	None	
160-10086-3	WAA-03-AF-PS-20150106	Total/NA	Filter	None	
160-10086-4	WAA-04-AF-PS-20150106	Total/NA	Filter	None	
160-10086-5	WAA-05-AF-PS-20150106	Total/NA	Filter	None	
160-10086-6	WAA-00-AF-FB-20150106	Total/NA	Filter	None	
LCS 160-168591/2-A	Lab Control Sample	Total/NA	Filter	None	
LCSB 160-168591/3-A	Lab Control Sample	Total/NA	Filter	None	
MB 160-168591/1-A	Method Blank	Total/NA	Filter	None	

#### Prep Batch: 168592

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-10086-1	WAA-01-AF-PS-20150106	Total/NA	Filter	None	
160-10086-1 DU	WAA-01-AF-PS-20150106	Total/NA	Filter	None	
160-10086-2	WAA-02-AF-PS-20150106	Total/NA	Filter	None	
160-10086-3	WAA-03-AF-PS-20150106	Total/NA	Filter	None	
160-10086-4	WAA-04-AF-PS-20150106	Total/NA	Filter	None	
160-10086-5	WAA-05-AF-PS-20150106	Total/NA	Filter	None	
160-10086-6	WAA-00-AF-FB-20150106	Total/NA	Filter	None	
LCS 160-168592/2-A	Lab Control Sample	Total/NA	Filter	None	
MB 160-168592/1-A	Method Blank	Total/NA	Filter	None	

**Tetra Tech, Inc.**  
**DATA VALIDATION REPORT**  
**LEVEL II**

Site: West Lake Landfill Site, Bridgeton, Missouri

Laboratory: TestAmerica Laboratories, Inc. (Earth City, Missouri)

Data Reviewer: Harry Ellis, Tetra Tech, Inc. (Tetra Tech)

Review Date: February 25, 2015

Sample Delivery Group (SDG): J10181

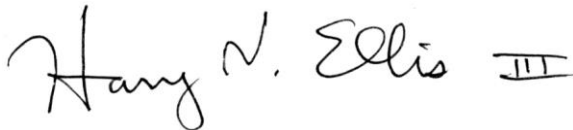
Sample Numbers: WAA-01-AF-PS-20150114, WAA-02-AF-PS-20150114, WAA-03-AF-PS-20150114, WAA-04-AF-PS-20150114, WAA-05-AF-PS-20150114, and WAA-00-AF-FB-20150114

Matrix / Number of Samples: 5 Air Samples and 1 Field Blank

The data were qualified according to the U.S. Environmental Protection Agency (EPA) Region 7 documents entitled "Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review" (9240.1-48), June 2008. In addition, the Tetra Tech document "Review of Data Packages from Subcontracted Laboratories" (February 2002) and the EPA and others document "Multi-Agency Radiological Laboratory Analytical Protocols Manual" (July 2004) were used along with other criteria specified in the applicable methods.

The review was intended to identify problems and quality control (QC) deficiencies that were readily apparent from the summary data package. The following sections discuss any problems or deficiencies that were found, and data qualifications applied because of non-compliant QC. The data review was limited to the available field and laboratory QC information submitted with the project-specific data package.

I, Harry Ellis, certify that all data validation criteria outlined in the above-referenced documents were assessed, and any qualifications made to the data accorded with those documents.



25 February 2015

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Certified by Harry Ellis, Chemist

---

Date



## DATA VALIDATION QUALIFIERS

- U** — The analyte was not detected above the reported sample quantitation limit.
- J** — The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.
- UJ** — The analyte was not detected above the reported sample quantitation limit, which is estimated.
- R** — The sample results are rejected due to serious deficiencies in the ability to analyze the sample and meet QC criteria. Presence or absence of the analyte cannot be verified.

## **DATA ASSESSMENT**

Sample delivery group (SDG) J10181 included five (5) environmental air (filter) samples and one (1) QC sample (a field blank). Samples were analyzed for total alpha-emitting radium by EPA SW-846 Method 9315 and for isotopic (alpha-emitting) thorium and radium by Department of Energy (DOE) Method A-01-R. The following summarizes the data validation that was performed.

### **RADIOANALYTICAL ANALYSES**

#### **I. Holding Time and Chain of Custody (COC) Requirements**

The samples were received by the laboratory and analyzed within the established holding time of 6 months from sample collection to analysis. No data were qualified.

#### **II. Matrix Spike/Matrix Spike Duplicate (MS/MSD)**

Insufficient sample was available for MS/MSD analyses. Duplicate LCS analysis provided adequate data on precision and accuracy. No qualifications were applied.

#### **III. Blanks**

The laboratory (method) blank and field blank yielded low activities for one (of three) thorium isotopes and for none (of three) uranium isotopes. No qualifications were applied.

#### **IV. Laboratory Control Sample (LCS)**

All percent recoveries and relative percent differences from the duplicate LCS analyses were within established control limits.

#### **V. Surrogates**

These radioanalytical methods use a “carrier” or “tracer”, whose recovery serves the same functions as surrogate recoveries. All carrier and tracer recoveries were within the laboratory’s QC limits. No qualifications were applied.

#### **VI. Comments**

All detected results were less than their reporting limits (“RL”). These extrapolations should be qualified as estimated (flagged “J”).

#### **VII. Overall Assessment of Data**

Overall data quality is acceptable, with few qualifications applied. All data are usable as qualified for their intended purposes.

# TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

## ANALYTICAL REPORT

TestAmerica Laboratories, Inc.

TestAmerica St. Louis  
13715 Rider Trail North  
Earth City, MO 63045  
Tel: (314)298-8566

TestAmerica Job ID: 160-10181-1

Client Project/Site: West Lake Landfill - Filters

For:

Tetra Tech EM Inc.  
415 Oak Street  
Kansas City, Missouri 64106

Attn: Ms. Emily Fisher



Authorized for release by:  
2/18/2015 2:44:59 PM

Erika Gish, Project Manager II  
(314)298-8566  
[erika.gish@testamericainc.com](mailto:erika.gish@testamericainc.com)

### LINKS

Review your project  
results through

TotalAccess

Have a Question?



Visit us at:

[www.testamericainc.com](http://www.testamericainc.com)

*This report has been electronically signed and authorized by the signatory. Electronic signature is intended to be the legally binding equivalent of a traditionally handwritten signature.*

*Results relate only to the items tested and the sample(s) as received by the laboratory.*

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## Case Narrative

Client: Tetra Tech EM Inc.  
Project/Site: West Lake Landfill - Filters

TestAmerica Job ID: 160-10181-1

**Job ID: 160-10181-1**

**Laboratory: TestAmerica St. Louis**

**Narrative**

### CASE NARRATIVE

**Client: Tetra Tech EM Inc.**

**Project: West Lake Landfill - Filters**

**Report Number: 160-10181-1**

With the exceptions noted as flags or footnotes, standard analytical protocols were followed in the analysis of the samples and no problems were encountered or anomalies observed. In addition all laboratory quality control samples were within established control limits, with any exceptions noted below. Each sample was analyzed to achieve the lowest possible reporting limit within the constraints of the method. In some cases, due to interference or analytes present at high concentrations, samples were diluted. For diluted samples, the reporting limits are adjusted relative to the dilution required.

TestAmerica St. Louis attests to the validity of the laboratory data generated by TestAmerica facilities reported herein. All analyses performed by TestAmerica facilities were done using established laboratory SOPs that incorporate QA/QC procedures described in the application methods. TestAmerica's operations groups have reviewed the data for compliance with the laboratory QA/QC plan, and data have been found to be compliant with laboratory protocols unless otherwise noted below.

The test results in this report meet all NELAP requirements for parameters for which accreditation is required or available. Any exceptions to NELAP requirements are noted in this report. Pursuant to NELAP, this report may not be reproduced, except in full, without the written approval of the laboratory.

Calculations are performed before rounding to avoid round-off errors in calculated results.

All holding times were met and proper preservation noted for the methods performed on these samples, unless otherwise detailed in the individual sections below.

All solid sample results for Chemistry analyses are reported on an "as received" basis unless otherwise indicated by the presence of a % solids value in the method header. All soil/sediment sample results for radiochemistry analyses are based upon sample as dried and disaggregated with the exception of tritium, carbon-14, and iodine-129 by gamma spectroscopy unless requested as wet weight by the client."

This laboratory report is confidential and is intended for the sole use of TestAmerica and its client.

#### **RECEIPT**

The samples were received on 1/19/2015 11:00 AM; the samples arrived in good condition, properly preserved. The temperature of the cooler at receipt was 20.0° C.

#### **TOTAL ALPHA RADIUM (GFPC)**

Samples WAA-01-AF-PS-20150114 (160-10181-1), WAA-02-AF-PS-20150114 (160-10181-2), WAA-03-AF-PS-20150114 (160-10181-3), WAA-04-AF-PS-20150114 (160-10181-4), WAA-05-AF-PS-20150114 (160-10181-5) and WAA-00-AF-FB-20150114 (160-10181-6) were analyzed for Total Alpha Radium (GFPC) in accordance with SW- 846 Method 9315. The samples were prepared on 01/29/2015 and analyzed on 02/03/2015 and 02/04/2015.

Insufficient sample volume was available to perform a sample duplicate (DUP). The samples are filters that must be split between multiple analysis. A LCS/LCSD was used instead of a sample duplicate.

No additional analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

## Case Narrative

Client: Tetra Tech EM Inc.  
Project/Site: West Lake Landfill - Filters

TestAmerica Job ID: 160-10181-1

### Job ID: 160-10181-1 (Continued)

#### Laboratory: TestAmerica St. Louis (Continued)

##### ISOTOPIC THORIUM (ALPHA SPECTROMETRY)

Samples WAA-01-AF-PS-20150114 (160-10181-1), WAA-02-AF-PS-20150114 (160-10181-2), WAA-03-AF-PS-20150114 (160-10181-3), WAA-04-AF-PS-20150114 (160-10181-4), WAA-05-AF-PS-20150114 (160-10181-5) and WAA-00-AF-FB-20150114 (160-10181-6) were analyzed for Isotopic Thorium (Alpha Spectrometry) in accordance with A-01-R. The samples were prepared on 01/29/2015 and analyzed on 02/05/2015.

Insufficient sample volume was available to perform a sample duplicate (DUP). The samples are filters that must be split between multiple analysis. A LCS/LCSD was used instead of a sample duplicate.

No additional analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

##### ISOTOPIC URANIUM (ALPHA SPECTROMETRY)

Samples WAA-01-AF-PS-20150114 (160-10181-1), WAA-02-AF-PS-20150114 (160-10181-2), WAA-03-AF-PS-20150114 (160-10181-3), WAA-04-AF-PS-20150114 (160-10181-4), WAA-05-AF-PS-20150114 (160-10181-5) and WAA-00-AF-FB-20150114 (160-10181-6) were analyzed for Isotopic Uranium (Alpha Spectrometry) in accordance with A-01-R. The samples were prepared on 01/29/2015 and analyzed on 02/05/2015.

Insufficient sample volume was available to perform a sample duplicate (DUP). The samples are filters that must be split between multiple analysis. A LCS/LCSD was used instead of a sample duplicate.

No additional analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

13715 Rider Trail North

Earth City, MO 63045  
phone 314.298.8566 fax

# TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

**TestAmerica Laboratories, Inc.**

[illegible]

Form No. CA-C-WI-002, Rev. 4.3, dated 12/05/2013

16U-10181 Chain of Custody

## Login Sample Receipt Checklist

Client: Tetra Tech EM Inc.

Job Number: 160-10181-1

Login Number: 10181

List Source: TestAmerica St. Louis

List Number: 1

Creator: Clarke, Jill C

Question	Answer	Comment
Radioactivity wasn't checked or is $\leq$ background as measured by a survey meter.	True	
The cooler's custody seal, if present, is intact.	N/A	
Sample custody seals, if present, are intact.	True	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	N/A	
Cooler Temperature is acceptable.	True	
Cooler Temperature is recorded.	True	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	N/A	
There are no discrepancies between the containers received and the COC.	True	
Samples are received within Holding Time.	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified.	True	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
Containers requiring zero headspace have no headspace or bubble is $<6\text{mm}$ (1/4").	N/A	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Residual Chlorine Checked.	N/A	



## Definitions/Glossary

Client: Tetra Tech EM Inc.  
Project/Site: West Lake Landfill - Filters

TestAmerica Job ID: 160-10181-1

### Qualifiers

#### Rad

Qualifier	Qualifier Description
U	Result is less than the sample detection limit.

### Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
α	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
CFL	Contains Free Liquid
CNF	Contains no Free Liquid
DER	Duplicate error ratio (normalized absolute difference)
Dil Fac	Dilution Factor
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision level concentration
MDA	Minimum detectable activity
EDL	Estimated Detection Limit
MDC	Minimum detectable concentration
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
NC	Not Calculated
ND	Not detected at the reporting limit (or MDL or EDL if shown)
PQL	Practical Quantitation Limit
QC	Quality Control
RER	Relative error ratio
RL	Reporting Limit or Requested Limit (Radiochemistry)
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)

## Method Summary

Client: Tetra Tech EM Inc.  
Project/Site: West Lake Landfill - Filters

TestAmerica Job ID: 160-10181-1

Method	Method Description	Protocol	Laboratory
9315	Total Alpha Radium (GFPC)	SW846	TAL SL
A-01-R	Isotopic Thorium (Alpha Spectrometry)	DOE	TAL SL
A-01-R	Isotopic Uranium (Alpha Spectrometry)	DOE	TAL SL

### Protocol References:

DOE = U.S. Department of Energy

SW846 = "Test Methods For Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 And Its Updates.

### Laboratory References:

TAL SL = TestAmerica St. Louis, 13715 Rider Trail North, Earth City, MO 63045, TEL (314)298-8566

## Sample Summary

Client: Tetra Tech EM Inc.  
Project/Site: West Lake Landfill - Filters

TestAmerica Job ID: 160-10181-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
160-10181-1	WAA-01-AF-PS-20150114	Filter	01/14/15 11:25	01/19/15 11:00
160-10181-2	WAA-02-AF-PS-20150114	Filter	01/14/15 10:15	01/19/15 11:00
160-10181-3	WAA-03-AF-PS-20150114	Filter	01/14/15 10:47	01/19/15 11:00
160-10181-4	WAA-04-AF-PS-20150114	Filter	01/14/15 11:06	01/19/15 11:00
160-10181-5	WAA-05-AF-PS-20150114	Filter	01/14/15 10:30	01/19/15 11:00
160-10181-6	WAA-00-AF-FB-20150114	Filter	01/14/15 00:00	01/19/15 11:00

# Client Sample Results

Client: Tetra Tech EM Inc.  
Project/Site: West Lake Landfill - Filters

TestAmerica Job ID 160-10181-1

Client Sample ID: WAA-01-AF-PS-20150114

Lab Sample ID: 160-10181-1

Date Collected: 01/14/15 11:25

Matrix: Filter

Date Received: 01/19/15 11:00

## Method: 9315 - Total Alpha Radium (GFPC)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Total Alpha Radium	0.131	U	0.231	0.231	1.00	0.400	pCi/Sample	01/29/15 12:44	02/03/15 19:17	1
Carrier	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Ba Carrier	105		40 - 110					01/29/15 12:44	02/03/15 19:17	1

## Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.0156	U	0.129	0.129	1.00	0.267	pCi/Sample	01/29/15 13:14	02/05/15 13:55	1
Thorium-230	0.297	J	0.164	0.166	1.00	0.137	pCi/Sample	01/29/15 13:14	02/05/15 13:55	1
Thorium-232	0.0791	U	0.0839	0.0841	1.00	0.0978	pCi/Sample	01/29/15 13:14	02/05/15 13:55	1
Tracer	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Thorium-229	85.8		30 - 110					01/29/15 13:14	02/05/15 13:55	1

## Method: A-01-R - Isotopic Uranium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Uranium-233/234	0.144	J	0.108	0.109	1.00	0.105	pCi/Sample	01/29/15 13:14	02/05/15 13:49	1
Uranium-235/236	0.0236	U	0.0471	0.0472	1.00	0.0707	pCi/Sample	01/29/15 13:14	02/05/15 13:49	1
Uranium-238	0.113	J	0.0926	0.0930	1.00	0.0567	pCi/Sample	01/29/15 13:14	02/05/15 13:49	1
Tracer	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Uranium-232	91.3		30 - 110					01/29/15 13:14	02/05/15 13:49	1

Client Sample ID: WAA-02-AF-PS-20150114

Lab Sample ID: 160-10181-2

Date Collected: 01/14/15 10:15

Matrix: Filter

Date Received: 01/19/15 11:00

## Method: 9315 - Total Alpha Radium (GFPC)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Total Alpha Radium	0.114	U	0.249	0.250	1.00	0.437	pCi/Sample	01/29/15 12:44	02/03/15 19:18	1
Carrier	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Ba Carrier	106		40 - 110					01/29/15 12:44	02/03/15 19:18	1

## Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.186	U	0.182	0.163	1.00	0.232	pCi/Sample	01/29/15 13:14	02/05/15 13:55	1
Thorium-230	0.201	J	0.134	0.135	1.00	0.117	pCi/Sample	01/29/15 13:14	02/05/15 13:55	1
Thorium-232	0.0420	U	0.0594	0.0595	1.00	0.0630	pCi/Sample	01/29/15 13:14	02/05/15 13:55	1

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TestAmerica St. Louis

# Client Sample Results

Client: Tetra Tech EM Inc.  
Project/Site: West Lake Landfill - Filters

TestAmerica Job ID: 160-10181-1

Client Sample ID: WAA-02-AF-PS-20150114

Lab Sample ID: 160-10181-2

Date Collected: 01/14/15 10:15

Matrix: Filter

Date Received: 01/19/15 11:00

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	81.8		30 - 110	01/29/15 13:14	02/05/15 13:55	1

Method: A-01-R - Isotopic Uranium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Uranium-233/234	0.0621	U	0.0708	0.0710	1.00	0.0958	pCi/Sample	01/29/15 13:14	02/05/15 13:49	1
Uranium-235/236	0.0431	U	0.0610	0.0611	1.00	0.0647	pCi/Sample	01/29/15 13:14	02/05/15 13:49	1
Uranium-238	0.0620	U	0.0707	0.0709	1.00	0.0956	pCi/Sample	01/29/15 13:14	02/05/15 13:49	1

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Uranium-232	95.2		30 - 110	01/29/15 13:14	02/05/15 13:49	1

Client Sample ID: WAA-03-AF-PS-20150114

Lab Sample ID: 160-10181-3

Date Collected: 01/14/15 10:47

Matrix: Filter

Date Received: 01/19/15 11:00

Method: 9315 - Total Alpha Radium (GFPC)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Total Alpha Radium	0.192	U	0.289	0.289	1.00	0.491	pCi/Sample	01/29/15 12:44	02/03/15 19:18	1

Carrier	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Ba Carrier	105		40 - 110	01/29/15 12:44	02/03/15 19:18	1

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.276	J	0.182	0.183	1.00	0.239	pCi/Sample	01/29/15 13:14	02/05/15 13:55	1
Thorium-230	0.395	J	0.177	0.180	1.00	0.123	pCi/Sample	01/29/15 13:14	02/05/15 13:55	1
Thorium-232	0.0622	U	0.0769	0.0771	1.00	0.115	pCi/Sample	01/29/15 13:14	02/05/15 13:55	1

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	90.7		30 - 110	01/29/15 13:14	02/05/15 13:55	1

Method: A-01-R - Isotopic Uranium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Uranium-233/234	0.0699	U	0.0797	0.0799	1.00	0.108	pCi/Sample	01/29/15 13:14	02/05/15 13:49	1
Uranium-235/236	0.0243	U	0.0485	0.0486	1.00	0.0728	pCi/Sample	01/29/15 13:14	02/05/15 13:49	1
Uranium-238	0.0778	J	0.0778	0.0781	1.00	0.0584	pCi/Sample	01/29/15 13:14	02/05/15 13:49	1

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Uranium-232	87.9		30 - 110	01/29/15 13:14	02/05/15 13:49	1

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TestAmerica St Louis

# Client Sample Results

Client Tetra Tech EM Inc.  
Project/Site: West Lake Landfill - Filters

TestAmerica Job ID: 160-10181-1

Client Sample ID: WAA-04-AF-PS-20150114

Lab Sample ID: 160-10181-4

Date Collected: 01/14/15 11:06

Matrix: Filter

Date Received: 01/19/15 11:00

## Method: 9315 - Total Alpha Radium (GFPC)

Analyte	Result	Qualifier	Count Uncert.	Total Uncert.	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Total Alpha Radium	0.133	U	0.226	0.227	1.00	0.391	pCi/Sample	01/29/15 12:44	02/03/15 19:18	1
Carrier	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Ba Carrier	108		40 - 110					01/29/15 12:44	02/03/15 19:18	1

## Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert.	Total Uncert.	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.220	U	0.178	0.179	1.00	0.253	pCi/Sample	01/29/15 13:14	02/05/15 13:55	1
Thorium-230	0.393	J	0.189	0.192	1.00	0.154	pCi/Sample	01/29/15 13:14	02/05/15 13:55	1
Thorium-232	0.0535	U	0.0738	0.0740	1.00	0.115	pCi/Sample	01/29/15 13:14	02/05/15 13:55	1
Tracer	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Thorium-229	82.2		30 - 110					01/29/15 13:14	02/05/15 13:55	1

## Method: A-01-R - Isotopic Uranium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert.	Total Uncert.	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Uranium-233/234	0.159	J	0.120	0.120	1.00	0.116	pCi/Sample	01/29/15 13:14	02/05/15 13:49	1
Uranium-235/236	-0.0108	U	0.0217	0.0217	1.00	0.144	pCi/Sample	01/29/15 13:14	02/05/15 13:49	1
Uranium-238	0.0417	U	0.0590	0.0591	1.00	0.0626	pCi/Sample	01/29/15 13:14	02/05/15 13:49	1
Tracer	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Uranium-232	82.3		30 - 110					01/29/15 13:14	02/05/15 13:49	1

Client Sample ID: WAA-05-AF-PS-20150114

Lab Sample ID: 160-10181-5

Date Collected: 01/14/15 10:30

Matrix: Filter

Date Received: 01/19/15 11:00

## Method: 9315 - Total Alpha Radium (GFPC)

Analyte	Result	Qualifier	Count Uncert.	Total Uncert.	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Total Alpha Radium	0.0257	U	0.160	0.160	1.00	0.308	pCi/Sample	01/29/15 12:44	02/04/15 07:07	1
Carrier	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Ba Carrier	104		40 - 110					01/29/15 12:44	02/04/15 07:07	1

## Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert.	Total Uncert.	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.264	J	0.179	0.181	1.00	0.236	pCi/Sample	01/29/15 13:14	02/05/15 13:55	1
Thorium-230	0.505	J	0.198	0.203	1.00	0.0584	pCi/Sample	01/29/15 13:14	02/05/15 13:55	1
Thorium-232	0.108	J	0.0962	0.0966	1.00	0.107	pCi/Sample	01/29/15 13:14	02/05/15 13:55	1
Tracer	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Thorium-229	88.4		30 - 110					01/29/15 13:14	02/05/15 13:55	1

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# Client Sample Results

Client: Tetra Tech EM Inc.  
Project/Site: West Lake Landfill - Filters

TestAmerica Job ID: 160-10181-1

Client Sample ID: WAA-05-AF-PS-20150114

Lab Sample ID: 160-10181-5

Date Collected: 01/14/15 10:30

Matrix: Filter

Date Received: 01/19/15 11:00

## Method: A-01-R - Isotopic Uranium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Uranium-233/234	0.0300	U	0.0864	0.0864	1.00	0.181	pCi/Sample	01/29/15 13:14	02/05/15 13:49	1
Uranium-235/236	0.0163	U	0.0606	0.0606	1.00	0.155	pCi/Sample	01/29/15 13:14	02/05/15 13:49	1
Uranium-238	0.0804	U	0.0918	0.0918	1.00	0.124	pCi/Sample	01/29/15 13:14	02/05/15 13:49	1
Tracer	% Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Uranium-232	78.3		30 - 110					01/29/15 13:14	02/05/15 13:49	1

Client Sample ID: WAA-00-AF-FB-20150114

Lab Sample ID: 160-10181-6

Date Collected: 01/14/15 00:00

Matrix: Filter

Date Received: 01/19/15 11:00

## Method: 9315 - Total Alpha Radium (GFPC)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Total Alpha Radium	0.0302	U	0.197	0.197	1.00	0.371	pCi/Sample	01/29/15 12:44	02/04/15 07:07	1
Carrier	% Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Ba Carrier	105		40 - 110					01/29/15 12:44	02/04/15 07:07	1

## Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.199	U	0.171	0.172	1.00	0.252	pCi/Sample	01/29/15 13:14	02/05/15 13:55	1
Thorium-230	0.315	U	0.156	0.158	1.00	0.0578	pCi/Sample	01/29/15 13:14	02/05/15 13:55	1
Thorium-232	0.000	U	0.0160	0.0160	1.00	0.0575	pCi/Sample	01/29/15 13:14	02/05/15 13:55	1
Tracer	% Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Thorium-229	90.3		30 - 110					01/29/15 13:14	02/05/15 13:55	1

## Method: A-01-R - Isotopic Uranium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Uranium-233/234	0.0227	U	0.0596	0.0596	1.00	0.128	pCi/Sample	01/29/15 13:14	02/05/15 13:49	1
Uranium-235/236	0.0101	U	0.0202	0.0202	1.00	0.134	pCi/Sample	01/29/15 13:14	02/05/15 13:49	1
Uranium-238	0.0889	U	0.0883	0.0886	1.00	0.107	pCi/Sample	01/29/15 13:14	02/05/15 13:49	1
Tracer	% Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Uranium-232	90.5		30 - 110					01/29/15 13:14	02/05/15 13:49	1

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TestAmerica St Louis

# QC Sample Results

Client: Tetra Tech EM Inc.  
Project/Site: West Lake Landfill - Filters

TestAmerica Job ID: 160-10181-1

## Method: 9315 - Total Apha Radium (GFPC)

Lab Sample ID: MB 160-171096/1-A

Matrix: Filter

Analysis Batch: 171817

Client Sample ID: Method Blank

Prep Type: Total/NA

Prep Batch: 171096

Analyte	MB Result	MB Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Total Alpha Radium	-0.1300	U	0.212	0.212	1.00	0.445	pCi/Sample	01/29/15 12:44	02/03/15 19:17	1
Carrier	MB %Yield	MB Qualifier	Limits					Prepared	Analyzed	Dil Fac
Ba Carrier	100		40 - 110					01/29/15 12:44	02/03/15 19:17	1

Lab Sample ID: LCS 160-171096/2-A

Matrix: Filter

Analysis Batch: 171589

Client Sample ID: Lab Control Sample

Prep Type: Total/NA

Prep Batch: 171096

Analyte	Spike Added	LCS Result	LCS Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits		
Total Alpha Radium	45.0	47.26		4.75	1.00	0.513	pCi/Samp	105	65 - 150		
Carrier	LCS %Yield	LCS Qualifier	Limits								
Ba Carrier	102		40 - 110								

Lab Sample ID: LCSD 160-171096/3-A

Matrix: Filter

Analysis Batch: 171589

Client Sample ID: Lab Control Sample Dup

Prep Type: Total/NA

Prep Batch: 171096

Analyte	Spike Added	LCSD Result	LCSD Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits	RER	RER Limit
Total Alpha Radium	45.0	43.07		4.37	1.00	0.459	pCi/Samp	96	65 - 150	0.46	1
Carrier	LCSD %Yield	LCSD Qualifier	Limits								
Ba Carrier	99.7		40 - 110								

## Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Lab Sample ID: MB 160-171102/1-A

Matrix: Filter

Analysis Batch: 172656

Client Sample ID: Method Blank

Prep Type: Total/NA

Prep Batch: 171102

Analyte	MB Result	MB Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.07666	U	0.145	0.145	1.00	0.261	pCi/Sample	01/29/15 13:14	02/05/15 13:55	1
Thorium-230	0.3524		0.176	0.178	1.00	0.134	pCi/Sample	01/29/15 13:14	02/05/15 13:55	1
Thorium-232	-0.008481	U	0.0170	0.0170	1.00	0.113	pCi/Sample	01/29/15 13:14	02/05/15 13:55	1
Tracer	MB %Yield	MB Qualifier	Limits					Prepared	Analyzed	Dil Fac
Thorium-229	86.8		30 - 110					01/29/15 13:14	02/05/15 13:55	1

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# QC Sample Results

Client: Tetra Tech EM Inc.  
Project/Site: West Lake Landfill - Filters

TestAmerica Job ID: 160-10181-1

## Method: A-01-R - Isotopic Thorium (Alpha Spectrometry) (Continued)

Lab Sample ID: LCS 160-171102/2-A

Matrix: Filter

Analysis Batch: 172675

Client Sample ID: Lab Control Sample

Prep Type: Total/NA

Prep Batch: 171102

Analyte	Spike Added	LCS Result	LCS Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits
Thorium-230	16.1	17.09		1.85	1.00	0.110	pCi/Samp	106	81 - 118
Tracer	LCS %Yield	LCS Qualifier	Limits						
Thorium-229	85.7		30 - 110						

Lab Sample ID: LCSD 160-171102/3-A

Matrix: Filter

Analysis Batch: 172658

Client Sample ID: Lab Control Sample Dup

Prep Type: Total/NA

Prep Batch: 171102

Analyte	Spike Added	LCSD Result	LCSD Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits	RER	RER Limit
Thorium-230	16.1	17.92		1.93	1.00	0.0607	pCi/Samp	112	81 - 118	0.22	1
Tracer	LCSD %Yield	LCSD Qualifier	Limits								
Thorium-229	84.8		30 - 110								

## Method: A-01-R - Isotopic Uranium (Alpha Spectrometry)

Lab Sample ID: MB 160-171103/1-A

Matrix: Filter

Analysis Batch: 172646

Client Sample ID: Method Blank

Prep Type: Total/NA

Prep Batch: 171103

Analyte	MB Result	MB Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Uranium-233/234	0.06692	U	0.0881	0.0883	1.00	0.139	pCi/Sample	01/29/15 13:14	02/05/15 13:49	1
Uranium-235/236	0.04164	U	0.0775	0.0776	1.00	0.145	pCi/Sample	01/29/15 13:14	02/05/15 13:49	1
Uranium-238	0.01230	U	0.0457	0.0457	1.00	0.117	pCi/Sample	01/29/15 13:14	02/05/15 13:49	1
Tracer	MB %Yield	MB Qualifier	Limits			Prepared	Analyzed	Dil Fac		
Uranium-232	79.1		30 - 110			01/29/15 13:14	02/05/15 13:49	1		

Lab Sample ID: LCS 160-171103/2-A

Matrix: Filter

Analysis Batch: 172647

Client Sample ID: Lab Control Sample

Prep Type: Total/NA

Prep Batch: 171103

Analyte	Spike Added	LCS Result	LCS Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits
Uranium-233/234	25.5	25.28		2.56	1.00	0.150	pCi/Samp	99	84 - 120
Uranium-238	26.0	26.31		2.65	1.00	0.133	pCi/Samp	101	82 - 122
Tracer	LCS %Yield	LCS Qualifier	Limits						
Uranium-232	83.0		30 - 110						

TestAmerica St. Louis

# QC Sample Results

Client: Tetra Tech EM Inc.  
Project/Site: West Lake Landfill - Filters

TestAmerica Job ID: 160-10181-1

## Method: A-01-R - Isotopic Uranium (Alpha Spectrometry) (Continued)

Lab Sample ID: LCSD 160-171103/3-A

Matrix: Filter

Analysis Batch: 172648

Client Sample ID: Lab Control Sample Dup

Prep Type: Total/NA

Prep Batch: 171103

Analyte	Spike Added	LCSD Result	LCSD Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits	RER	RER Limit
Uranium-233/234	25.5	25.49		2.59	1.00	0.168	pCi/Samp	100	84 - 120	0.04	1
Uranium-238	26.0	26.27		2.66	1.00	0.0625	pCi/Samp	101	82 - 122	0.01	1

Tracer	LCSD %Yield	LCSD Qualifier	Limits
Uranium-232	83.8		30 - 110

# QC Association Summary

Client: Tetra Tech EM Inc.  
Project/Site: West Lake Landfill - Filters

TestAmerica Job ID: 160-10181-1

## Rad

### Prep Batch: 171096

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-10181-1	WAA-01-AF-PS-20150114	Total/NA	Filter	DPS-0	
160-10181-2	WAA-02-AF-PS-20150114	Total/NA	Filter	DPS-0	
160-10181-3	WAA-03-AF-PS-20150114	Total/NA	Filter	DPS-0	
160-10181-4	WAA-04-AF-PS-20150114	Total/NA	Filter	DPS-0	
160-10181-5	WAA-05-AF-PS-20150114	Total/NA	Filter	DPS-0	
160-10181-6	WAA-00-AF-FB-20150114	Total/NA	Filter	DPS-0	
LCS 160-171096/2-A	Lab Control Sample	Total/NA	Filter	DPS-0	
LCSD 160-171096/3-A	Lab Control Sample Dup	Total/NA	Filter	DPS-0	
MB 160-171096/1-A	Method Blank	Total/NA	Filter	DPS-0	

### Prep Batch: 171102

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-10181-1	WAA-01-AF-PS-20150114	Total/NA	Filter	ExtChrom	
160-10181-2	WAA-02-AF-PS-20150114	Total/NA	Filter	ExtChrom	
160-10181-3	WAA-03-AF-PS-20150114	Total/NA	Filter	ExtChrom	
160-10181-4	WAA-04-AF-PS-20150114	Total/NA	Filter	ExtChrom	
160-10181-5	WAA-05-AF-PS-20150114	Total/NA	Filter	ExtChrom	
160-10181-6	WAA-00-AF-FB-20150114	Total/NA	Filter	ExtChrom	
LCS 160-171102/2-A	Lab Control Sample	Total/NA	Filter	ExtChrom	
LCSD 160-171102/3-A	Lab Control Sample Dup	Total/NA	Filter	ExtChrom	
MB 160-171102/1-A	Method Blank	Total/NA	Filter	ExtChrom	

### Prep Batch: 171103

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-10181-1	WAA-01-AF-PS-20150114	Total/NA	Filter	ExtChrom	
160-10181-2	WAA-02-AF-PS-20150114	Total/NA	Filter	ExtChrom	
160-10181-3	WAA-03-AF-PS-20150114	Total/NA	Filter	ExtChrom	
160-10181-4	WAA-04-AF-PS-20150114	Total/NA	Filter	ExtChrom	
160-10181-5	WAA-05-AF-PS-20150114	Total/NA	Filter	ExtChrom	
160-10181-6	WAA-00-AF-FB-20150114	Total/NA	Filter	ExtChrom	
LCS 160-171103/2-A	Lab Control Sample	Total/NA	Filter	ExtChrom	
LCSD 160-171103/3-A	Lab Control Sample Dup	Total/NA	Filter	ExtChrom	
MB 160-171103/1-A	Method Blank	Total/NA	Filter	ExtChrom	

## Tracer/Carrier Summary

Client: Tetra Tech EM Inc.  
Project/Site: West Lake Landfill - Filters

TestAmerica Job ID: 160-10181-1

### Method: 9315 - Total Apha Radium (GFPC)

Matrix: Filter

Prep Type: Total/NA

		Percent Yield (Acceptance Limits)					
Lab Sample ID	Client Sample ID	Ba (40-110)					
160-10181-1	WAA-01-AF-PS-20150114	105					
160-10181-2	WAA-02-AF-PS-20150114	106					
160-10181-3	WAA-03-AF-PS-20150114	105					
160-10181-4	WAA-04-AF-PS-20150114	108					
160-10181-5	WAA-05-AF-PS-20150114	104					
160-10181-6	WAA-00-AF-FB-20150114	105					
LCS 160-171096/2-A	Lab Control Sample	102					
LCSD 160-171096/3-A	Lab Control Sample Dup	99.7					
MB 160-171096/1-A	Method Blank	100					
<b>Tracer/Carrier Legend</b>							
Ba = Ba Carrier							

### Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Matrix: Filter

Prep Type: Total/NA

		Percent Yield (Acceptance Limits)					
Lab Sample ID	Client Sample ID	Th-229 (30-110)					
160-10181-1	WAA-01-AF-PS-20150114	85.8					
160-10181-2	WAA-02-AF-PS-20150114	81.8					
160-10181-3	WAA-03-AF-PS-20150114	90.7					
160-10181-4	WAA-04-AF-PS-20150114	82.2					
160-10181-5	WAA-05-AF-PS-20150114	88.4					
160-10181-6	WAA-00-AF-FB-20150114	90.3					
LCS 160-171102/2-A	Lab Control Sample	85.7					
LCSD 160-171102/3-A	Lab Control Sample Dup	84.8					
MB 160-171102/1-A	Method Blank	86.8					
<b>Tracer/Carrier Legend</b>							
Th-229 = Thorium-229							

### Method: A-01-R - Isotopic Uranium (Alpha Spectrometry)

Matrix: Filter

Prep Type: Total/NA

		Percent Yield (Acceptance Limits)					
Lab Sample ID	Client Sample ID	U-232 (30-110)					
160-10181-1	WAA-01-AF-PS-20150114	91.3					
160-10181-2	WAA-02-AF-PS-20150114	95.2					
160-10181-3	WAA-03-AF-PS-20150114	87.9					
160-10181-4	WAA-04-AF-PS-20150114	82.3					
160-10181-5	WAA-05-AF-PS-20150114	78.3					
160-10181-6	WAA-00-AF-FB-20150114	90.5					
LCS 160-171103/2-A	Lab Control Sample	83.0					
LCSD 160-171103/3-A	Lab Control Sample Dup	83.8					
MB 160-171103/1-A	Method Blank	79.1					
<b>Tracer/Carrier Legend</b>							
U-232 = Uranium-232							

TestAmerica St. Louis

**Tetra Tech, Inc.**  
**DATA VALIDATION REPORT**  
**LEVEL II**

Site: West Lake Landfill Site, Bridgeton, Missouri

Laboratory: TestAmerica Laboratories, Inc. (Earth City, Missouri)

Data Reviewer: Harry Ellis, Tetra Tech, Inc. (Tetra Tech)

Review Date: February 25, 2015

Sample Delivery Group (SDG): J10273

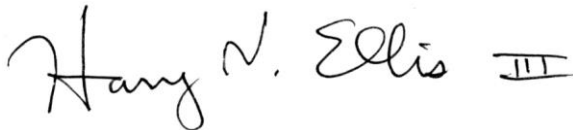
Sample Numbers: WAA-01-AF-PS-20150121, WAA-02-AF-PS-20150121, WAA-03-AF-PS-20150121, WAA-04-AF-PS-20150121, WAA-05-AF-PS-20150121, and WAA-00-AF-FB-20150121

Matrix / Number of Samples: 5 Air Samples and 1 Field Blank

The data were qualified according to the U.S. Environmental Protection Agency (EPA) Region 7 documents entitled "Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review" (9240.1-48), June 2008. In addition, the Tetra Tech document "Review of Data Packages from Subcontracted Laboratories" (February 2002) and the EPA and others document "Multi-Agency Radiological Laboratory Analytical Protocols Manual" (July 2004) were used along with other criteria specified in the applicable methods.

The review was intended to identify problems and quality control (QC) deficiencies that were readily apparent from the summary data package. The following sections discuss any problems or deficiencies that were found, and data qualifications applied because of non-compliant QC. The data review was limited to the available field and laboratory QC information submitted with the project-specific data package.

I, Harry Ellis, certify that all data validation criteria outlined in the above-referenced documents were assessed, and any qualifications made to the data accorded with those documents.



25 February 2015

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Certified by Harry Ellis, Chemist

---

Date

## DATA VALIDATION QUALIFIERS

- U** — The analyte was not detected above the reported sample quantitation limit.
- J** — The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.
- UJ** — The analyte was not detected above the reported sample quantitation limit, which is estimated.
- R** — The sample results are rejected due to serious deficiencies in the ability to analyze the sample and meet QC criteria. Presence or absence of the analyte cannot be verified.

## **DATA ASSESSMENT**

Sample delivery group (SDG) J10273 included five (5) environmental air (filter) samples and one (1) QC sample (a field blank). Samples were analyzed for total alpha-emitting radium by EPA SW-846 Method 9315 and for isotopic (alpha-emitting) thorium and radium by Department of Energy (DOE) Method A-01-R. The following summarizes the data validation that was performed.

### **RADIOANALYTICAL ANALYSES**

#### **I. Holding Time and Chain of Custody (COC) Requirements**

The samples were received by the laboratory and analyzed within the established holding time of 6 months from sample collection to analysis. No data were qualified.

#### **II. Matrix Spike/Matrix Spike Duplicate (MS/MSD)**

Insufficient sample was available for MS/MSD analyses. Duplicate LCS analysis provided adequate data on precision and accuracy. No qualifications were applied.

#### **III. Blanks**

The laboratory (method) blank and field blank yielded low activities for two (of three) thorium isotopes and for none (of three) uranium isotopes. No qualifications were applied.

#### **IV. Laboratory Control Sample (LCS)**

All percent recoveries and relative percent differences from the duplicate LCS analyses were within established control limits.

#### **V. Surrogates**

These radioanalytical methods use a “carrier” or “tracer”, whose recovery serves the same functions as surrogate recoveries. All carrier and tracer recoveries were within the laboratory’s QC limits. No qualifications were applied.

#### **VI. Comments**

All detected results were less than their reporting limits (“RL”). These extrapolations should be qualified as estimated (flagged “J”).

#### **VII. Overall Assessment of Data**

Overall data quality is acceptable, with few qualifications applied. All data are usable as qualified for their intended purposes.

# TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

## ANALYTICAL REPORT

TestAmerica Laboratories, Inc.

TestAmerica St. Louis  
13715 Rider Trail North  
Earth City, MO 63045  
Tel: (314)298-8566

TestAmerica Job ID: 160-10273-1

Client Project/Site: West Lake Landfill - Filters

For:

Tetra Tech EM Inc.  
415 Oak Street  
Kansas City, Missouri 64106

Attn: Ms. Emily Fisher



Authorized for release by:  
2/24/2015 10:35:35 AM

Erika Gish, Project Manager II  
(314)298-8566  
[erika.gish@testamericainc.com](mailto:erika.gish@testamericainc.com)

### LINKS

Review your project  
results through

TotalAccess

Have a Question?



Visit us at:

[www.testamericainc.com](http://www.testamericainc.com)

*This report has been electronically signed and authorized by the signatory. Electronic signature is intended to be the legally binding equivalent of a traditionally handwritten signature.*

*Results relate only to the items tested and the sample(s) as received by the laboratory.*

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## Case Narrative

Client: Tetra Tech EM Inc.  
Project/Site: West Lake Landfill - Filters

TestAmerica Job ID: 160-10273-1

**Job ID: 160-10273-1**

**Laboratory: TestAmerica St. Louis**

**Narrative**

### CASE NARRATIVE

**Client: Tetra Tech EM Inc.**

**Project: West Lake Landfill - Filters**

**Report Number: 160-10273-1**

With the exceptions noted as flags or footnotes, standard analytical protocols were followed in the analysis of the samples and no problems were encountered or anomalies observed. In addition all laboratory quality control samples were within established control limits, with any exceptions noted below. Each sample was analyzed to achieve the lowest possible reporting limit within the constraints of the method. In some cases, due to interference or analytes present at high concentrations, samples were diluted. For diluted samples, the reporting limits are adjusted relative to the dilution required.

TestAmerica St. Louis attests to the validity of the laboratory data generated by TestAmerica facilities reported herein. All analyses performed by TestAmerica facilities were done using established laboratory SOPs that incorporate QA/QC procedures described in the application methods. TestAmerica's operations groups have reviewed the data for compliance with the laboratory QA/QC plan, and data have been found to be compliant with laboratory protocols unless otherwise noted below.

The test results in this report meet all NELAP requirements for parameters for which accreditation is required or available. Any exceptions to NELAP requirements are noted in this report. Pursuant to NELAP, this report may not be reproduced, except in full, without the written approval of the laboratory.

Calculations are performed before rounding to avoid round-off errors in calculated results.

All holding times were met and proper preservation noted for the methods performed on these samples, unless otherwise detailed in the individual sections below.

All solid sample results for Chemistry analyses are reported on an "as received" basis unless otherwise indicated by the presence of a % solids value in the method header. All soil/sediment sample results for radiochemistry analyses are based upon sample as dried and disaggregated with the exception of tritium, carbon-14, and iodine-129 by gamma spectroscopy unless requested as wet weight by the client."

This laboratory report is confidential and is intended for the sole use of TestAmerica and its client.

#### **RECEIPT**

The samples were received on 1/26/2015 11:30 AM; the samples arrived in good condition, properly preserved. The temperature of the cooler at receipt was 18.0° C.

#### **TOTAL ALPHA RADIUM (GFPC)**

Samples WAA-01-AF-PS-20150121 (160-10273-1), WAA-02-AF-PS-20150121 (160-10273-2), WAA-03-AF-PS-20150121 (160-10273-3), WAA-04-AF-PS-20150121 (160-10273-4), WAA-05-AF-PS-20150121 (160-10273-5) and WAA-00-AF-FB-20150121 (160-10273-6) were analyzed for Total Alpha Radium (GFPC) in accordance with SW- 846 Method 9315. The samples were prepared on 02/02/2015 and analyzed on 02/10/2015.

Insufficient sample volume was available to perform a sample duplicate (DUP). The samples are filters that must be split between multiple analysis. A LCS/LCSD was used instead of a sample duplicate.

No additional analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

#### **ISOTOPIC THORIUM (ALPHA SPECTROMETRY)**

## Case Narrative

Client: Tetra Tech EM Inc.  
Project/Site: West Lake Landfill - Filters

TestAmerica Job ID: 160-10273-1

### Job ID: 160-10273-1 (Continued)

#### Laboratory: TestAmerica St. Louis (Continued)

Samples WAA-01-AF-PS-20150121 (160-10273-1), WAA-02-AF-PS-20150121 (160-10273-2), WAA-03-AF-PS-20150121 (160-10273-3), WAA-04-AF-PS-20150121 (160-10273-4), WAA-05-AF-PS-20150121 (160-10273-5) and WAA-00-AF-FB-20150121 (160-10273-6) were analyzed for Isotopic Thorium (Alpha Spectrometry) in accordance with A-01-R. The samples were prepared on 02/02/2015 and analyzed on 02/12/2015.

Insufficient sample volume was available to perform a sample duplicate (DUP). The samples are filters that must be split between multiple analysis. A LCS/LCSD was used instead of a sample duplicate.

No additional analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

#### ISOTOPIC URANIUM (ALPHA SPECTROMETRY)

Samples WAA-01-AF-PS-20150121 (160-10273-1), WAA-02-AF-PS-20150121 (160-10273-2), WAA-03-AF-PS-20150121 (160-10273-3), WAA-04-AF-PS-20150121 (160-10273-4), WAA-05-AF-PS-20150121 (160-10273-5) and WAA-00-AF-FB-20150121 (160-10273-6) were analyzed for Isotopic Uranium (Alpha Spectrometry) in accordance with A-01-R. The samples were prepared on 02/02/2015 and analyzed on 02/11/2015.

Insufficient sample volume was available to perform a sample duplicate (DUP). The samples are filters that must be split between multiple analysis. A LCS/LCSD was used instead of a sample duplicate.

No additional analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

13715 Rider Trail North

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

Earth City, MO 63045  
phone 314.298.8566 fax

Regulatory Program: ☐ DW ☐ NPDES ☐ RCRA ☐ Other:

**TestAmerica Laboratories, Inc.**

[illegible]

Form No. CA-C-WI-002, Rev. 4.3, dated 12/05/2013

## Login Sample Receipt Checklist

Client: Tetra Tech EM Inc.

Job Number: 160-10273-1

Login Number: 10273

List Source: TestAmerica St. Louis

List Number: 1

Creator: Daniels, Brian J

Question	Answer	Comment
Radioactivity wasn't checked or is </= background as measured by a survey meter.	True	
The cooler's custody seal, if present, is intact.	N/A	
Sample custody seals, if present, are intact.	True	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	N/A	
Cooler Temperature is acceptable.	True	
Cooler Temperature is recorded.	True	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	N/A	
There are no discrepancies between the containers received and the COC.	True	
Samples are received within Holding Time.	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified.	True	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
Containers requiring zero headspace have no headspace or bubble is <6mm (1/4").	N/A	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Residual Chlorine Checked.	N/A	

## Definitions/Glossary

Client: Tetra Tech EM Inc.  
Project/Site: West Lake Landfill - Filters

TestAmerica Job ID: 160-10273-1

### Qualifiers

#### Rad

Qualifier	Qualifier Description
U	Result is less than the sample detection limit.

### Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
α	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
CFL	Contains Free Liquid
CNF	Contains no Free Liquid
DER	Duplicate error ratio (normalized absolute difference)
Dil Fac	Dilution Factor
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision level concentration
MDA	Minimum detectable activity
EDL	Estimated Detection Limit
MDC	Minimum detectable concentration
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
NC	Not Calculated
ND	Not detected at the reporting limit (or MDL or EDL if shown)
PQL	Practical Quantitation Limit
QC	Quality Control
RER	Relative error ratio
RL	Reporting Limit or Requested Limit (Radiochemistry)
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)

## Method Summary

Client: Tetra Tech EM Inc.  
Project/Site: West Lake Landfill - Filters

TestAmerica Job ID: 160-10273-1

Method	Method Description	Protocol	Laboratory
9315	Total Alpha Radium (GFPC)	SW846	TAL SL
A-01-R	Isotopic Thorium (Alpha Spectrometry)	DOE	TAL SL
A-01-R	Isotopic Uranium (Alpha Spectrometry)	DOE	TAL SL

### Protocol References:

DOE = U.S. Department of Energy

SW846 = "Test Methods For Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 And Its Updates.

### Laboratory References:

TAL SL = TestAmerica St. Louis, 13715 Rider Trail North, Earth City, MO 63045, TEL (314)298-8566

## Sample Summary

Client: Tetra Tech EM Inc.

TestAmerica Job ID: 160-10273-1

Project/Site: West Lake Landfill - Filters

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
160-10273-1	WAA-01-AF-PS-20150121	Filter	01/21/15 11:22	01/26/15 11:30
160-10273-2	WAA-02-AF-PS-20150121	Filter	01/21/15 10:15	01/26/15 11:30
160-10273-3	WAA-03-AF-PS-20150121	Filter	01/21/15 10:53	01/26/15 11:30
160-10273-4	WAA-04-AF-PS-20150121	Filter	01/21/15 11:08	01/26/15 11:30
160-10273-5	WAA-05-AF-PS-20150121	Filter	01/21/15 10:31	01/26/15 11:30
160-10273-6	WAA-00-AF-FB-20150121	Filter	01/21/15 00:00	01/26/15 11:30



# Client Sample Results

Client: Tetra Tech EM Inc.  
Project/Site: West Lake Landfill - Filters

TestAmerica Job ID: 160-10273-1

Client Sample ID: WAA-01-AF-PS-20150121

Lab Sample ID: 160-10273-1

Date Collected: 01/21/15 11:22

Matrix: Filter

Date Received: 01/26/15 11:30

## Method: 9315 - Total Alpha Radium (GFPC)

Analyte	Result	Qualifier	Count Uncert.	Total Uncert.	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Total Alpha Radium	0.0168	U	(2σ+/-) 0.227	(2σ+/-) 0.227	1.00	0.419	pCi/Sample	02/02/15 13:30	02/10/15 12:11	1
Carrier	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Ba Carrier	103		40 - 110					02/02/15 13:30	02/10/15 12:11	1

## Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert.	Total Uncert.	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.213	U	(2σ+/-) 0.204	(2σ+/-) 0.205	1.00	0.315	pCi/Sample	02/02/15 10:42	02/12/15 18:31	1
Thorium-230	0.506	J	(2σ+/-) 0.217	(2σ+/-) 0.222	1.00	0.151	pCi/Sample	02/02/15 10:42	02/12/15 18:31	1
Thorium-232	0.108	U	(2σ+/-) 0.128	(2σ+/-) 0.128	1.00	0.202	pCi/Sample	02/02/15 10:42	02/12/15 18:31	1
Tracer	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Thorium-229	77.3		30 - 110					02/02/15 10:42	02/12/15 18:31	1

## Method: A-01-R - Isotopic Uranium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert.	Total Uncert.	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Uranium-233/234	0.160	U	(2σ+/-) 0.135	(2σ+/-) 0.136	1.00	0.188	pCi/Sample	02/02/15 10:42	02/11/15 13:45	1
Uranium-235/236	0.0134	U	(2σ+/-) 0.0499	(2σ+/-) 0.0499	1.00	0.127	pCi/Sample	02/02/15 10:42	02/11/15 13:45	1
Uranium-238	0.0585	U	(2σ+/-) 0.0770	(2σ+/-) 0.0772	1.00	0.121	pCi/Sample	02/02/15 10:42	02/11/15 13:45	1
Tracer	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Uranium-232	92.0		30 - 110					02/02/15 10:42	02/11/15 13:45	1

Client Sample ID: WAA-02-AF-PS-20150121

Lab Sample ID: 160-10273-2

Date Collected: 01/21/15 10:15

Matrix: Filter

Date Received: 01/26/15 11:30

## Method: 9315 - Total Alpha Radium (GFPC)

Analyte	Result	Qualifier	Count Uncert.	Total Uncert.	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Total Alpha Radium	0.227	U	(2σ+/-) 0.226	(2σ+/-) 0.227	1.00	0.363	pCi/Sample	02/02/15 13:30	02/10/15 17:54	1
Carrier	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Ba Carrier	106		40 - 110					02/02/15 13:30	02/10/15 17:54	1

## Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert.	Total Uncert.	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.314	J	(2σ+/-) 0.193	(2σ+/-) 0.195	1.00	0.249	pCi/Sample	02/02/15 10:42	02/12/15 18:31	1
Thorium-230	0.451	J	(2σ+/-) 0.187	(2σ+/-) 0.191	1.00	0.122	pCi/Sample	02/02/15 10:42	02/12/15 18:31	1
Thorium-232	0.0139	U	(2σ+/-) 0.0587	(2σ+/-) 0.0587	1.00	0.136	pCi/Sample	02/02/15 10:42	02/12/15 18:31	1

HUG 25 February 2015

TestAmerica St. Louis

# Client Sample Results

Client: Tetra Tech EM Inc.  
Project/Site: West Lake Landfill - Filters

TestAmerica Job ID: 160-10273-1

Client Sample ID: WAA-02-AF-PS-20150121

Lab Sample ID: 160-10273-2

Date Collected: 01/21/15 10:15

Matrix: Filter

Date Received: 01/26/15 11:30

Tracer	% Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	92.7		30 - 110	02/02/15 10:42	02/12/15 18:31	1

Method: A-01-R - Isotopic Uranium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Uranium-233/234	0.153	J	0.122	0.123	1.00	0.146	pCi/Sample	02/02/15 10:42	02/11/15 13:45	1
Uranium-235/236	0.0144	U	0.0533	0.0533	1.00	0.136	pCi/Sample	02/02/15 10:42	02/11/15 13:45	1
Uranium-238	-0.0411	U	0.0368	0.0369	1.00	0.171	pCi/Sample	02/02/15 10:42	02/11/15 13:45	1

Tracer	% Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Uranium-232	85.0		30 - 110	02/02/15 10:42	02/11/15 13:45	1

Client Sample ID: WAA-03-AF-PS-20150121

Lab Sample ID: 160-10273-3

Date Collected: 01/21/15 10:53

Matrix: Filter

Date Received: 01/26/15 11:30

Method: 9315 - Total Alpha Radium (GFPC)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Total Alpha Radium	0.198	U	0.218	0.219	1.00	0.355	pCi/Sample	02/02/15 13:30	02/10/15 17:54	1

Carrier	% Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Ba Carrier	104		40 - 110	02/02/15 13:30	02/10/15 17:54	1

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.368	J	0.188	0.190	1.00	0.178	pCi/Sample	02/02/15 10:42	02/12/15 18:31	1
Thorium-230	0.527	J	0.218	0.222	1.00	0.166	pCi/Sample	02/02/15 10:42	02/12/15 18:31	1
Thorium-232	0.0717	U	0.0828	0.0830	1.00	0.113	pCi/Sample	02/02/15 10:42	02/12/15 18:31	1

Tracer	% Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	83.4		30 - 110	02/02/15 10:42	02/12/15 18:31	1

Method: A-01-R - Isotopic Uranium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Uranium-233/234	0.0316	U	0.0677	0.0678	1.00	0.133	pCi/Sample	02/02/15 10:42	02/11/15 13:45	1
Uranium-235/236	0.0131	U	0.0486	0.0487	1.00	0.124	pCi/Sample	02/02/15 10:42	02/11/15 13:45	1
Uranium-238	0.191	J	0.120	0.121	1.00	0.0995	pCi/Sample	02/02/15 10:42	02/11/15 13:45	1

Tracer	% Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Uranium-232	96.7		30 - 110	02/02/15 10:42	02/11/15 13:45	1

17UG 25 Feb 15

TestAmerica St. Louis

# Client Sample Results

Client: Tetra Tech EM Inc.  
Project/Site: West Lake Landfill - Filters

TestAmerica Job ID: 160-10273-1

Client Sample ID: WAA-04-AF-PS-20150121

Lab Sample ID: 160-10273-4

Date Collected: 01/21/15 11:08

Matrix: Filter

Date Received: 01/26/15 11:30

## Method: 9315 - Total Alpha Radium (GFPC)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Total Alpha Radium	0.0806	U	0.144	0.144	1.00	0.253	pCi/Sample	02/02/15 13:30	02/10/15 17:54	1
Carrier	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Ba Carrier	107		40 - 110					02/02/15 13:30	02/10/15 17:54	1

## Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.412	J	0.207	0.210	1.00	0.212	pCi/Sample	02/02/15 10:42	02/12/15 18:31	1
Thorium-230	0.249	J	0.161	0.163	1.00	0.181	pCi/Sample	02/02/15 10:42	02/12/15 18:31	1
Thorium-232	0.0834	J	0.0834	0.0837	1.00	0.0625	pCi/Sample	02/02/15 10:42	02/12/15 18:31	1
Tracer	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Thorium-229	82.7		30 - 110					02/02/15 10:42	02/12/15 18:31	1

## Method: A-01-R - Isotopic Uranium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Uranium-233/234	0.116	J	0.0943	0.0948	1.00	0.0578	pCi/Sample	02/02/15 10:42	02/11/15 13:45	1
Uranium-235/236	0.0479	U	0.0678	0.0679	1.00	0.0719	pCi/Sample	02/02/15 10:42	02/11/15 13:45	1
Uranium-238	0.0881	U	0.0874	0.0877	1.00	0.106	pCi/Sample	02/02/15 10:42	02/11/15 13:45	1
Tracer	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Uranium-232	89.5		30 - 110					02/02/15 10:42	02/11/15 13:45	1

Client Sample ID: WAA-05-AF-PS-20150121

Lab Sample ID: 160-10273-5

Date Collected: 01/21/15 10:31

Matrix: Filter

Date Received: 01/26/15 11:30

## Method: 9315 - Total Alpha Radium (GFPC)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Total Alpha Radium	0.386	U	0.250	0.253	1.00	0.372	pCi/Sample	02/02/15 13:30	02/10/15 17:54	1
Carrier	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Ba Carrier	105		40 - 110					02/02/15 13:30	02/10/15 17:54	1

## Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.246	J	0.152	0.153	1.00	0.170	pCi/Sample	02/02/15 10:42	02/12/15 18:31	1
Thorium-230	0.452	J	0.196	0.199	1.00	0.170	pCi/Sample	02/02/15 10:42	02/12/15 18:31	1
Thorium-232	0.0321	U	0.0689	0.0690	1.00	0.136	pCi/Sample	02/02/15 10:42	02/12/15 18:31	1
Tracer	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Thorium-229	92.2		30 - 110					02/02/15 10:42	02/12/15 18:31	1

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# Client Sample Results

Client: Tetra Tech EM Inc.  
Project/Site: West Lake Landfill - Filters

TestAmerica Job ID: 160-10273-1

Client Sample ID: WAA-05-AF-PS-20150121

Lab Sample ID: 160-10273-5

Date Collected: 01/21/15 10:31

Matrix: Filter

Date Received: 01/26/15 11:30

## Method: A-01-R - Isotopic Uranium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Uranium-233/234	0.104	3	0.0926	0.0930	1.00	0.103	pCi/Sample	02/02/15 10:42	02/11/15 13:45	1
Uranium-235/236	0.0232	4	0.0464	0.0464	1.00	0.0696	pCi/Sample	02/02/15 10:42	02/11/15 13:45	1
Uranium-238	0.0589	4	0.0775	0.0777	1.00	0.122	pCi/Sample	02/02/15 10:42	02/11/15 13:45	1
Tracer	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Uranium-232	92.1		30 - 110					02/02/15 10:42	02/11/15 13:45	1

Client Sample ID: WAA-00-AF-FB-20150121

Lab Sample ID: 160-10273-6

Date Collected: 01/21/15 00:00

Matrix: Filter

Date Received: 01/26/15 11:30

## Method: 9315 - Total Alpha Radium (GFPC)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Total Alpha Radium	0.0332	4	0.226	0.226	1.00	0.414	pCi/Sample	02/02/15 13:30	02/10/15 17:54	1
Carrier	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Ba Carrier	103		40 - 110					02/02/15 13:30	02/10/15 17:54	1

## Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.327	3	0.197	0.199	1.00	0.249	pCi/Sample	02/02/15 10:42	02/12/15 18:31	1
Thorium-230	0.227	3	0.143	0.144	1.00	0.144	pCi/Sample	02/02/15 10:42	02/12/15 18:31	1
Thorium-232	0.0374	4	0.0720	0.0721	1.00	0.137	pCi/Sample	02/02/15 10:42	02/12/15 18:31	1
Tracer	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Thorium-229	88.1		30 - 110					02/02/15 10:42	02/12/15 18:31	1

## Method: A-01-R - Isotopic Uranium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Uranium-233/234	0.0913	4	0.0890	0.0894	1.00	0.116	pCi/Sample	02/02/15 10:42	02/11/15 13:45	1
Uranium-235/236	0.0348	4	0.0648	0.0649	1.00	0.122	pCi/Sample	02/02/15 10:42	02/11/15 13:45	1
Uranium-238	0.0558	4	0.0735	0.0737	1.00	0.116	pCi/Sample	02/02/15 10:42	02/11/15 13:45	1
Tracer	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Uranium-232	95.2		30 - 110					02/02/15 10:42	02/11/15 13:45	1

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# QC Sample Results

Client: Tetra Tech EM Inc.  
Project/Site: West Lake Landfill - Filters

TestAmerica Job ID: 160-10273-1

## Method: 9315 - Total Apha Radium (GFPC)

Lab Sample ID: MB 160-171582/1-A

Matrix: Filter

Analysis Batch: 173100

Client Sample ID: Method Blank

Prep Type: Total/NA

Prep Batch: 171582

Analyte	MB Result	MB Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Total Alpha Radium	0.03252	U	0.205	0.205	1.00	0.381	pCi/Sample	02/02/15 13:30	02/10/15 12:10	1
Carrier	MB %Yield	MB Qualifier	Limits					Prepared	Analyzed	Dil Fac
Ba Carrier	95.3		40 - 110					02/02/15 13:30	02/10/15 12:10	1

Lab Sample ID: LCS 160-171582/2-A

Matrix: Filter

Analysis Batch: 173651

Client Sample ID: Lab Control Sample

Prep Type: Total/NA

Prep Batch: 171582

Analyte	Spike Added	LCS Result	LCS Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits	
Total Alpha Radium	45.0	42.27		4.17	1.00	0.333	pCi/Samp	94	65 - 150	
Carrier	LCS %Yield	LCS Qualifier	Limits							
Ba Carrier	96.8		40 - 110							

Lab Sample ID: LCSD 160-171582/3-A

Matrix: Filter

Analysis Batch: 173651

Client Sample ID: Lab Control Sample Dup

Prep Type: Total/NA

Prep Batch: 171582

Analyte	Spike Added	LCSD Result	LCSD Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits	RER	RER Limit
Total Alpha Radium	45.0	38.69		3.85	1.00	0.360	pCi/Samp	86	65 - 150	0.45	1
Carrier	LCSD %Yield	LCSD Qualifier	Limits								
Ba Carrier	97.1		40 - 110								

## Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Lab Sample ID: MB 160-171556/1-A

Matrix: Filter

Analysis Batch: 174062

Client Sample ID: Method Blank

Prep Type: Total/NA

Prep Batch: 171556

Analyte	MB Result	MB Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.3207		0.165	0.167	1.00	0.130	pCi/Sample	02/02/15 10:42	02/12/15 18:32	1
Thorium-230	0.3532		0.176	0.178	1.00	0.146	pCi/Sample	02/02/15 10:42	02/12/15 18:32	1
Thorium-232	-0.01646	U	0.0233	0.0233	1.00	0.130	pCi/Sample	02/02/15 10:42	02/12/15 18:32	1
Tracer	MB %Yield	MB Qualifier	Limits					Prepared	Analyzed	Dil Fac
Thorium-229	84.8		30 - 110					02/02/15 10:42	02/12/15 18:32	1

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# QC Sample Results

Client: Tetra Tech EM Inc.  
Project/Site: West Lake Landfill - Filters

TestAmerica Job ID: 160-10273-1

## Method: A-01-R - Isotopic Thorium (Alpha Spectrometry) (Continued)

Lab Sample ID: LCS 160-171556/2-A

Matrix: Filter

Analysis Batch: 174063

Client Sample ID: Lab Control Sample

Prep Type: Total/NA

Prep Batch: 171556

Analyte	Spike Added	LCS Result	LCS Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits
Thorium-230	16.1	18.01		1.91	1.00	0.0574	pCi/Samp	112	81 - 118

Tracer	LCS %Yield	LCS Qualifier	Limits
Thorium-229	88.7		30 - 110

Lab Sample ID: LCSD 160-171556/3-A

Matrix: Filter

Analysis Batch: 174065

Client Sample ID: Lab Control Sample Dup

Prep Type: Total/NA

Prep Batch: 171556

Analyte	Spike Added	LCSD Result	LCSD Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits	RER	RER Limit
Thorium-230	16.1	18.73		2.01	1.00	0.0632	pCi/Samp	117	81 - 118	0.18	1

Tracer	LCSD %Yield	LCSD Qualifier	Limits
Thorium-229	82.3		30 - 110

## Method: A-01-R - Isotopic Uranium (Alpha Spectrometry)

Lab Sample ID: MB 160-171559/1-A

Matrix: Filter

Analysis Batch: 173515

Client Sample ID: Method Blank

Prep Type: Total/NA

Prep Batch: 171559

Analyte	MB Result	MB Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Uranium-233/234	0.06663	U	0.0835	0.0837	1.00	0.131	pCi/Sample	02/02/15 10:42	02/11/15 13:45	1
Uranium-235/236	-0.01843	U	0.0261	0.0261	1.00	0.145	pCi/Sample	02/02/15 10:42	02/11/15 13:45	1
Uranium-238	0.0000	U	0.0148	0.0148	1.00	0.0532	pCi/Sample	02/02/15 10:42	02/11/15 13:45	1

Tracer	MB %Yield	MB Qualifier	Limits	Prepared	Analyzed	Dil Fac
Uranium-232	99.3		30 - 110	02/02/15 10:42	02/11/15 13:45	1

Lab Sample ID: LCS 160-171559/2-A

Matrix: Filter

Analysis Batch: 173517

Client Sample ID: Lab Control Sample

Prep Type: Total/NA

Prep Batch: 171559

Analyte	Spike Added	LCS Result	LCS Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits
Uranium-233/234	25.5	24.82		2.51	1.00	0.182	pCi/Samp	97	84 - 120
Uranium-238	26.0	26.31		2.64	1.00	0.192	pCi/Samp	101	82 - 122

Tracer	LCS %Yield	LCS Qualifier	Limits
Uranium-232	89.3		30 - 110

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# QC Sample Results

Client: Tetra Tech EM Inc.  
Project/Site: West Lake Landfill - Filters

TestAmerica Job ID: 160-10273-1

## Method: A-01-R - Isotopic Uranium (Alpha Spectrometry) (Continued)

Lab Sample ID: LCSD 160-171559/3-A

Matrix: Filter

Analysis Batch: 173518

Client Sample ID: Lab Control Sample Dup

Prep Type: Total/NA

Prep Batch: 171559

Analyte	Spike Added	LCSD Result	LCSD Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits	RER	RER Limit
Uranium-233/234	25.5	25.29		2.56	1.00	0.132	pCi/Samp	99	84 - 120	0.09	1
Uranium-238	26.0	26.20		2.63	1.00	0.0601	pCi/Samp	101	82 - 122	0.02	1
Tracer	LCSD %Yield	LCSD Qualifier	Limits								
Uranium-232	87.7		30 - 110								

# QC Association Summary

Client: Tetra Tech EM Inc.  
Project/Site: West Lake Landfill - Filters

TestAmerica Job ID: 160-10273-1

## Rad

### Prep Batch: 171556

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-10273-1	WAA-01-AF-PS-20150121	Total/NA	Filter	ExtChrom	
160-10273-2	WAA-02-AF-PS-20150121	Total/NA	Filter	ExtChrom	
160-10273-3	WAA-03-AF-PS-20150121	Total/NA	Filter	ExtChrom	
160-10273-4	WAA-04-AF-PS-20150121	Total/NA	Filter	ExtChrom	
160-10273-5	WAA-05-AF-PS-20150121	Total/NA	Filter	ExtChrom	
160-10273-6	WAA-00-AF-FB-20150121	Total/NA	Filter	ExtChrom	
LCS 160-171556/2-A	Lab Control Sample	Total/NA	Filter	ExtChrom	
LCSD 160-171556/3-A	Lab Control Sample Dup	Total/NA	Filter	ExtChrom	
MB 160-171556/1-A	Method Blank	Total/NA	Filter	ExtChrom	

### Prep Batch: 171559

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-10273-1	WAA-01-AF-PS-20150121	Total/NA	Filter	ExtChrom	
160-10273-2	WAA-02-AF-PS-20150121	Total/NA	Filter	ExtChrom	
160-10273-3	WAA-03-AF-PS-20150121	Total/NA	Filter	ExtChrom	
160-10273-4	WAA-04-AF-PS-20150121	Total/NA	Filter	ExtChrom	
160-10273-5	WAA-05-AF-PS-20150121	Total/NA	Filter	ExtChrom	
160-10273-6	WAA-00-AF-FB-20150121	Total/NA	Filter	ExtChrom	
LCS 160-171559/2-A	Lab Control Sample	Total/NA	Filter	ExtChrom	
LCSD 160-171559/3-A	Lab Control Sample Dup	Total/NA	Filter	ExtChrom	
MB 160-171559/1-A	Method Blank	Total/NA	Filter	ExtChrom	

### Prep Batch: 171582

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-10273-1	WAA-01-AF-PS-20150121	Total/NA	Filter	DPS-0	
160-10273-2	WAA-02-AF-PS-20150121	Total/NA	Filter	DPS-0	
160-10273-3	WAA-03-AF-PS-20150121	Total/NA	Filter	DPS-0	
160-10273-4	WAA-04-AF-PS-20150121	Total/NA	Filter	DPS-0	
160-10273-5	WAA-05-AF-PS-20150121	Total/NA	Filter	DPS-0	
160-10273-6	WAA-00-AF-FB-20150121	Total/NA	Filter	DPS-0	
LCS 160-171582/2-A	Lab Control Sample	Total/NA	Filter	DPS-0	
LCSD 160-171582/3-A	Lab Control Sample Dup	Total/NA	Filter	DPS-0	
MB 160-171582/1-A	Method Blank	Total/NA	Filter	DPS-0	

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## Tracer/Carrier Summary

Client: Tetra Tech EM Inc.  
Project/Site: West Lake Landfill - Filters

TestAmerica Job ID: 160-10273-1

### Method: 9315 - Total Apha Radium (GFPC)

Matrix: Filter

Prep Type: Total/NA

		Percent Yield (Acceptance Limits)					
Lab Sample ID	Client Sample ID	Ba (40-110)					
160-10273-1	WAA-01-AF-PS-20150121	103					
160-10273-2	WAA-02-AF-PS-20150121	106					
160-10273-3	WAA-03-AF-PS-20150121	104					
160-10273-4	WAA-04-AF-PS-20150121	107					
160-10273-5	WAA-05-AF-PS-20150121	105					
160-10273-6	WAA-00-AF-FB-20150121	103					
LCS 160-171582/2-A	Lab Control Sample	96.8					
LCSD 160-171582/3-A	Lab Control Sample Dup	97.1					
MB 160-171582/1-A	Method Blank	95.3					
<b>Tracer/Carrier Legend</b>							
Ba = Ba Carrier							

### Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Matrix: Filter

Prep Type: Total/NA

		Percent Yield (Acceptance Limits)					
Lab Sample ID	Client Sample ID	Th-229 (30-110)					
160-10273-1	WAA-01-AF-PS-20150121	77.3					
160-10273-2	WAA-02-AF-PS-20150121	92.7					
160-10273-3	WAA-03-AF-PS-20150121	83.4					
160-10273-4	WAA-04-AF-PS-20150121	82.7					
160-10273-5	WAA-05-AF-PS-20150121	92.2					
160-10273-6	WAA-00-AF-FB-20150121	88.1					
LCS 160-171556/2-A	Lab Control Sample	88.7					
LCSD 160-171556/3-A	Lab Control Sample Dup	82.3					
MB 160-171556/1-A	Method Blank	84.8					
<b>Tracer/Carrier Legend</b>							
Th-229 = Thorium-229							

### Method: A-01-R - Isotopic Uranium (Alpha Spectrometry)

Matrix: Filter

Prep Type: Total/NA

		Percent Yield (Acceptance Limits)					
Lab Sample ID	Client Sample ID	U-232 (30-110)					
160-10273-1	WAA-01-AF-PS-20150121	92.0					
160-10273-2	WAA-02-AF-PS-20150121	85.0					
160-10273-3	WAA-03-AF-PS-20150121	96.7					
160-10273-4	WAA-04-AF-PS-20150121	89.5					
160-10273-5	WAA-05-AF-PS-20150121	92.1					
160-10273-6	WAA-00-AF-FB-20150121	95.2					
LCS 160-171559/2-A	Lab Control Sample	89.3					
LCSD 160-171559/3-A	Lab Control Sample Dup	87.7					
MB 160-171559/1-A	Method Blank	99.3					
<b>Tracer/Carrier Legend</b>							
U-232 = Uranium-232							

TestAmerica St. Louis

**Tetra Tech, Inc.**  
**DATA VALIDATION REPORT**  
**LEVEL II**

Site: West Lake Landfill Site, Bridgeton, Missouri

Laboratory: TestAmerica Laboratories, Inc. (Earth City, Missouri)

Data Reviewer: Harry Ellis, Tetra Tech, Inc. (Tetra Tech)

Review Date: February 25, 2015

Sample Delivery Group (SDG): J10333

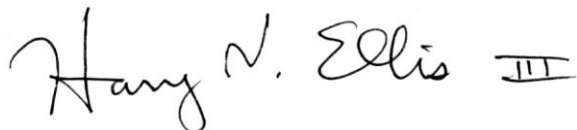
Sample Numbers: WAA-01-AF-PS-20150128, WAA-02-AF-PS-20150128, WAA-03-AF-PS-20150128, WAA-04-AF-PS-20150128, WAA-05-AF-PS-20150128, and WAA-00-AF-FB-20150128

Matrix / Number of Samples: 5 Air Samples and 1 Field Blank

The data were qualified according to the U.S. Environmental Protection Agency (EPA) Region 7 documents entitled "Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review" (9240.1-48), June 2008. In addition, the Tetra Tech document "Review of Data Packages from Subcontracted Laboratories" (February 2002) and the EPA and others document "Multi-Agency Radiological Laboratory Analytical Protocols Manual" (July 2004) were used along with other criteria specified in the applicable methods.

The review was intended to identify problems and quality control (QC) deficiencies that were readily apparent from the summary data package. The following sections discuss any problems or deficiencies that were found, and data qualifications applied because of non-compliant QC. The data review was limited to the available field and laboratory QC information submitted with the project-specific data package.

I, Harry Ellis, certify that all data validation criteria outlined in the above-referenced documents were assessed, and any qualifications made to the data accorded with those documents.



25 February 2015

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Certified by Harry Ellis, Chemist

---

Date

## DATA VALIDATION QUALIFIERS

- U** — The analyte was not detected above the reported sample quantitation limit.
- J** — The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.
- UJ** — The analyte was not detected above the reported sample quantitation limit, which is estimated.
- R** — The sample results are rejected due to serious deficiencies in the ability to analyze the sample and meet QC criteria. Presence or absence of the analyte cannot be verified.

## **DATA ASSESSMENT**

Sample delivery group (SDG) J10333 included five (5) environmental air (filter) samples and one (1) QC samples (a field blank). Samples were analyzed for gross alpha and beta radiation by EPA SW-846 Method 9310 and for cesium-137 and other gamma-emitters by Department of Energy (DOE) Method Ga-01-R. The following summarizes the data validation that was performed.

### **RADIOANALYTICAL ANALYSES**

#### **I. Holding Time and Chain of Custody (COC) Requirements**

The samples were received by the laboratory and analyzed within the established holding time of 6 months from sample collection to analysis. No data were qualified.

#### **II. Matrix Spike/Matrix Spike Duplicate (MS/MSD)**

MS/MSD analyses are not practical for air analyses. LCS and duplicate sample analysis provided adequate data on precision and accuracy. No qualifications were applied.

#### **III. Blanks**

The laboratory (method) blank yielded no detectable activities and the field blank a low beta activity. The other field samples yielded more than 5 times the field blank beta activity, so no further qualifications were applied.

#### **IV. Laboratory Control Sample (LCS)**

All percent recoveries from the LCS analyses were within established control limits. No qualifications were applied.

#### **V. Surrogates**

Surrogates are not used in these radioanalytical methods.

#### **VI. Comments**

Some detected activities were less than their reporting limits ("RL"). These extrapolations should be qualified as estimated (flagged "J").

#### **VII. Overall Assessment of Data**

Overall data quality is acceptable, with no significant qualifications applied. All data are usable as qualified for their intended purposes.

# TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

## ANALYTICAL REPORT

TestAmerica Laboratories, Inc.

TestAmerica St. Louis  
13715 Rider Trail North  
Earth City, MO 63045  
Tel: (314)298-8566

TestAmerica Job ID: 160-10333-2

Client Project/Site: West Lake Landfill - Filters

For:

Tetra Tech EM Inc.  
415 Oak Street  
Kansas City, Missouri 64106

Attn: Ms. Emily Fisher

*Elizabeth M. Hoerchler*

Authorized for release by:

2/10/2015 3:32:55 PM

Elizabeth Hoerchler, Project Mgmt. Assistant  
[elizabeth.hoerchler@testamericainc.com](mailto:elizabeth.hoerchler@testamericainc.com)

Designee for

Erika Gish, Project Manager II  
(314)298-8566  
[erika.gish@testamericainc.com](mailto:erika.gish@testamericainc.com)

### LINKS

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results through

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*This report has been electronically signed and authorized by the signatory. Electronic signature is intended to be the legally binding equivalent of a traditionally handwritten signature.*

*Results relate only to the items tested and the sample(s) as received by the laboratory.*

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## Case Narrative

Client: Tetra Tech EM Inc.  
Project/Site: West Lake Landfill - Filters

TestAmerica Job ID: 160-10333-2

**Job ID: 160-10333-2**

**Laboratory: TestAmerica St. Louis**

### Narrative

## CASE NARRATIVE

**Client: Tetra Tech EM Inc.**

**Project: West Lake Landfill - Filters**

**Report Number: 160-10333-2**

With the exceptions noted as flags or footnotes, standard analytical protocols were followed in the analysis of the samples and no problems were encountered or anomalies observed. In addition all laboratory quality control samples were within established control limits, with any exceptions noted below. Each sample was analyzed to achieve the lowest possible reporting limit within the constraints of the method. In some cases, due to interference or analytes present at high concentrations, samples were diluted. For diluted samples, the reporting limits are adjusted relative to the dilution required.

TestAmerica St. Louis attests to the validity of the laboratory data generated by TestAmerica facilities reported herein. All analyses performed by TestAmerica facilities were done using established laboratory SOPs that incorporate QA/QC procedures described in the application methods. TestAmerica's operations groups have reviewed the data for compliance with the laboratory QA/QC plan, and data have been found to be compliant with laboratory protocols unless otherwise noted below.

The test results in this report meet all NELAP requirements for parameters for which accreditation is required or available. Any exceptions to NELAP requirements are noted in this report. Pursuant to NELAP, this report may not be reproduced, except in full, without the written approval of the laboratory.

Calculations are performed before rounding to avoid round-off errors in calculated results.

All holding times were met and proper preservation noted for the methods performed on these samples, unless otherwise detailed in the individual sections below.

All solid sample results for Chemistry analyses are reported on an "as received" basis unless otherwise indicated by the presence of a % solids value in the method header. All soil/sediment sample results for radiochemistry analyses are based upon sample as dried and disaggregated with the exception of tritium, carbon-14, and iodine-129 by gamma spectroscopy unless requested as wet weight by the client."

This laboratory report is confidential and is intended for the sole use of TestAmerica and its client.

### RECEIPT

The samples were received on 02/02/2015; the samples arrived in good condition and properly preserved. The temperature of the coolers at receipt was 19.0° C.

### GROSS ALPHA AND GROSS BETA RADIOACTIVITY

Samples WAA-01-AF-PS-20150128 (160-10333-1), WAA-02-AF-PS-20150128 (160-10333-2), WAA-03-AF-PS-20150128 (160-10333-3), WAA-04-AF-PS-20150128 (160-10333-4), WAA-05-AF-PS-20150128 (160-10333-5) and WAA-00-AF-FB-20150128 (160-10333-6) were analyzed for Gross Alpha and Gross Beta Radioactivity in accordance with SW846 9310. The samples were prepared and analyzed on 02/03/2015.

No analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

### RADIUM-226 & OTHER GAMMA EMITTERS (GS)

Samples WAA-01-AF-PS-20150128 (160-10333-1), WAA-02-AF-PS-20150128 (160-10333-2), WAA-03-AF-PS-20150128 (160-10333-3), WAA-04-AF-PS-20150128 (160-10333-4), WAA-05-AF-PS-20150128 (160-10333-5) and WAA-00-AF-FB-20150128 (160-10333-6) were

## Case Narrative

Client: Tetra Tech EM Inc.  
Project/Site: West Lake Landfill - Filters

TestAmerica Job ID: 160-10333-2

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### Job ID: 160-10333-2 (Continued)

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#### Laboratory: TestAmerica St. Louis (Continued)

analyzed for Radium-226 & Other Gamma Emitters (GS) in accordance with GA-01-R. The samples were prepared and analyzed on 02/03/2015.

No additional analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

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13715 Rider Trail North

## Chain of Custody Record

Earth City, MO 63045  
phone 314.298.8566 fax

# TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

**TestAmerica Laboratories, Inc.**

Regulatory Program: ☐ DW ☐ NPDES ☐ RCRA ☐ Other:

Client Contact		Project Manager: Dave Kinroth		Site Contact: Dave Kinroth		Date: 2-2-15		COC No:							
Tel/Fax: 314-517-6798		Lab Contact: Mike Franks		Carrier: NA		1 of 1 COCs		Sampler:							
Analysis Turnaround Time		<input type="checkbox"/> CALENDAR DAYS <input checked="" type="checkbox"/> WORKING DAYS						For Lab Use Only:							
TAT if different from Below 20		<input type="checkbox"/> 2 weeks						Walk-in Client:							
<input type="checkbox"/> 1 week		<input type="checkbox"/> 2 days						Lab Sampling:							
<input type="checkbox"/> 1 day								Job / SDG No.:							
Sample Identification		Sample Date	Sample Time	Sample Type (C=Comp, G=Grab)	Matrix	# of Cont.	Filtered Sample (Y/N)	Perform MS / MSD (Y/N)	9310 Gross Alpha/Beta	GA-01-R Gamma Spec	9315 Total Alpha Radium	A-01-R Isotopic Thorium	A-01-R Isotopic Uranium	* 9315 Radium-226 (GFPC)	Sample Specific Notes:
WAA-01-AF-PS-20150128	1/28/15	11:12	Filter	Air	1			X	X	X	X	X	X	X	* 9315 Radium-226 (GFPC)
WAA-02-AF-PS-20150128	1/28/15	10:12	Filter	Air	1			X	X	X	X	X	X	X	contingent upon TAR results
WAA-03-AF-PS-20150128	1/28/15	10:40	Filter	Air	1			X	X	X	X	X	X	X	for all samples
WAA-04-AF-PS-20150128	1/28/15	10:58	Filter	Air	1			X	X	X	X	X	X	X	
WAA-05-AF-PS-20150128	1/28/15	10:25	Filter	Air	1			X	X	X	X	X	X	X	
WAA-00-AF-FB-20150128	1/28/15	NA	Filter	Air	1			X	X	X	X	X	X	X	
Preservation Used: 1= Ice, 2= HCl, 3= H2SO4, 4= HNO3, 5= NaOH, 6= Other															
Possible Hazard Identification: Are any samples from a listed EPA Hazardous Waste? Please List any EPA Waste Codes for the sample in the Comments Section if the lab is to dispose of the sample.							Sample Disposal ( A fee may be assessed if samples are retained longer than 1 month)								
<input checked="" type="checkbox"/> Non-Hazard <input type="checkbox"/> Flammable <input type="checkbox"/> Skin Irritant <input type="checkbox"/> Poison B <input type="checkbox"/> Unknown							<input type="checkbox"/> Return to Client <input type="checkbox"/> Disposal by Lab <input type="checkbox"/> Archive for _____ Months								
Special Instructions/QC Requirements & Comments:															
Custody Seals Intact: <input type="checkbox"/> Yes <input type="checkbox"/> No		Custody Seal No.:		Cooler Temp. (°C): Obs'd: _____ Cor'd: _____		Therm ID No.:									
Relinquished by: <i>Terry Bonleau</i>		Company: <i>Tetra Tech</i>		Date/Time: <i>1/28/15 1320</i>		Received by: <i>[Signature]</i>		Company: <i>TB</i>		Date/Time: <i>2-2-15 1320</i>					
Relinquished by:		Company:		Date/Time:		Received by:		Company:		Date/Time:					
Relinquished by:		Company:		Date/Time:		Received in Laboratory by:		Company:		Date/Time:					

## Login Sample Receipt Checklist

Client: Tetra Tech EM Inc.

Job Number: 160-10333-2

Login Number: 10333

List Source: TestAmerica St. Louis

List Number: 1

Creator: Clarke, Jill C

Question	Answer	Comment
Radioactivity wasn't checked or is $\leq$ background as measured by a survey meter.	True	
The cooler's custody seal, if present, is intact.	N/A	
Sample custody seals, if present, are intact.	True	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	N/A	
Cooler Temperature is acceptable.	True	
Cooler Temperature is recorded.	True	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	N/A	
There are no discrepancies between the containers received and the COC.	True	
Samples are received within Holding Time.	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified.	True	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
Containers requiring zero headspace have no headspace or bubble is $<6\text{mm}$ (1/4").	N/A	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Residual Chlorine Checked.	N/A	

## Definitions/Glossary

Client: Tetra Tech EM Inc.  
Project/Site: West Lake Landfill - Filters

TestAmerica Job ID: 160-10333-2

### Qualifiers

#### Rad

Qualifier	Qualifier Description
U	Result is less than the sample detection limit.

### Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
α	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
CFL	Contains Free Liquid
CNF	Contains no Free Liquid
DER	Duplicate error ratio (normalized absolute difference)
Dil Fac	Dilution Factor
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision level concentration
MDA	Minimum detectable activity
EDL	Estimated Detection Limit
MDC	Minimum detectable concentration
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
NC	Not Calculated
ND	Not detected at the reporting limit (or MDL or EDL if shown)
PQL	Practical Quantitation Limit
QC	Quality Control
RER	Relative error ratio
RL	Reporting Limit or Requested Limit (Radiochemistry)
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)

## Method Summary

Client: Tetra Tech EM Inc.  
Project/Site: West Lake Landfill - Filters

TestAmerica Job ID: 160-10333-2

Method	Method Description	Protocol	Laboratory
9310	Gross Alpha / Beta (GFPC)	SW846	TAL SL
GA-01-R	Cesium-137 & Other Gamma Emitters (GS)	DOE	TAL SL

### Protocol References:

DOE = U.S. Department of Energy

SW846 = "Test Methods For Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 And Its Updates.

### Laboratory References:

TAL SL = TestAmerica St. Louis, 13715 Rider Trail North, Earth City, MO 63045, TEL (314)298-8566

## Sample Summary

Client: Tetra Tech EM Inc.

TestAmerica Job ID: 160-10333-2

Project/Site: West Lake Landfill - Filters

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
160-10333-1	WAA-01-AF-PS-20150128	Filter	01/28/15 11:12	02/02/15 13:20
160-10333-2	WAA-02-AF-PS-20150128	Filter	01/28/15 10:12	02/02/15 13:20
160-10333-3	WAA-03-AF-PS-20150128	Filter	01/28/15 10:40	02/02/15 13:20
160-10333-4	WAA-04-AF-PS-20150128	Filter	01/28/15 10:58	02/02/15 13:20
160-10333-5	WAA-05-AF-PS-20150128	Filter	01/28/15 10:25	02/02/15 13:20
160-10333-6	WAA-00-AF-FB-20150128	Filter	01/28/15 00:00	02/02/15 13:20

# Client Sample Results

Client: Tetra Tech EM Inc.  
Project/Site: West Lake Landfill - Filters

TestAmerica Job ID: 160-10333-2

Client Sample ID: WAA-01-AF-PS-20150128

Lab Sample ID: 160-10333-1

Date Collected: 01/28/15 11:12

Matrix: Filter

Date Received: 02/02/15 13:20

## Method: 9310 - Gross Alpha / Beta (GFPC)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Gross Alpha	0.359	3	0.234	0.237	10.0	0.281	pCi/Sample	02/03/15 13:35	02/03/15 20:50	1
Gross Beta	10.7		0.914	1.41	10.0	0.350	pCi/Sample	02/03/15 13:35	02/03/15 20:50	1

## Method: GA-01-R - Cesium-137 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Cesium-137	-0.386	U	3.85	3.85	20.0	7.42	pCi/Sample	02/03/15 13:37	02/03/15 18:42	1

Other Detected Radionuclides	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Other Detected Radionuclide	None						pCi/Sample	02/03/15 13:37	02/03/15 18:42	1

Client Sample ID: WAA-02-AF-PS-20150128

Lab Sample ID: 160-10333-2

Date Collected: 01/28/15 10:12

Matrix: Filter

Date Received: 02/02/15 13:20

## Method: 9310 - Gross Alpha / Beta (GFPC)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Gross Alpha	0.464	3	0.271	0.276	10.0	0.324	pCi/Sample	02/03/15 13:35	02/03/15 20:50	1
Gross Beta	10.3		0.902	1.37	10.0	0.371	pCi/Sample	02/03/15 13:35	02/03/15 20:50	1

## Method: GA-01-R - Cesium-137 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Cesium-137	-1.63	U	5.26	5.27	20.0	9.32	pCi/Sample	02/03/15 13:37	02/03/15 18:44	1

Other Detected Radionuclides	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Other Detected Radionuclide	None						pCi/Sample	02/03/15 13:37	02/03/15 18:44	1

Client Sample ID: WAA-03-AF-PS-20150128

Lab Sample ID: 160-10333-3

Date Collected: 01/28/15 10:40

Matrix: Filter

Date Received: 02/02/15 13:20

## Method: 9310 - Gross Alpha / Beta (GFPC)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Gross Alpha	0.0904	U	0.164	0.165	10.0	0.297	pCi/Sample	02/03/15 13:35	02/03/15 20:51	1
Gross Beta	12.9		0.998	1.63	10.0	0.370	pCi/Sample	02/03/15 13:35	02/03/15 20:51	1

HUE 25 February 2016

TestAmerica St Louis

# Client Sample Results

Client: Tetra Tech EM Inc  
Project/Site: West Lake Landfill - Filters

TestAmerica Job ID: 160-10333-2

Client Sample ID: WAA-03-AF-PS-20150128

Lab Sample ID: 160-10333-3

Date Collected: 01/28/15 10:40

Matrix: Filter

Date Received: 02/02/15 13:20

## Method: GA-01-R - Cesium-137 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Cesium-137	1.31	U	4.35	4.35	20.0	7.87	pCi/Sample	02/03/15 13:37	02/03/15 18:44	1
Other Detected										
Radionuclides	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Other Detected Radionuclide	None						pCi/Sample	02/03/15 13:37	02/03/15 18:44	1

Client Sample ID: WAA-04-AF-PS-20150128

Lab Sample ID: 160-10333-4

Date Collected: 01/28/15 10:58

Matrix: Filter

Date Received: 02/02/15 13:20

## Method: 9310 - Gross Alpha / Beta (GFPC)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Gross Alpha	0.334	U	0.254	0.257	10.0	0.358	pCi/Sample	02/03/15 13:35	02/03/15 20:51	1
Gross Beta	11.0		0.927	1.44	10.0	0.389	pCi/Sample	02/03/15 13:35	02/03/15 20:51	1

## Method: GA-01-R - Cesium-137 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Cesium-137	1.40	U	5.95	5.95	20.0	10.9	pCi/Sample	02/03/15 13:37	02/03/15 19:06	1
Other Detected										
Radionuclides	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Other Detected Radionuclide	None						pCi/Sample	02/03/15 13:37	02/03/15 19:06	1

Client Sample ID: WAA-05-AF-PS-20150128

Lab Sample ID: 160-10333-5

Date Collected: 01/28/15 10:25

Matrix: Filter

Date Received: 02/02/15 13:20

## Method: 9310 - Gross Alpha / Beta (GFPC)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Gross Alpha	0.238	U	0.235	0.236	10.0	0.362	pCi/Sample	02/03/15 13:35	02/03/15 20:51	1
Gross Beta	10.0		0.884	1.33	10.0	0.379	pCi/Sample	02/03/15 13:35	02/03/15 20:51	1

## Method: GA-01-R - Cesium-137 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Cesium-137	-1.41	U	6.11	6.12	20.0	10.9	pCi/Sample	02/03/15 13:37	02/03/15 19:46	1

HUG 25 Feb 15

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# Client Sample Results

Client: Tetra Tech EM Inc.  
Project/Site: West Lake Landfill - Filters

TestAmerica Job ID: 160-10333-2

Client Sample ID: WAA-05-AF-PS-20150128

Lab Sample ID: 160-10333-5

Date Collected: 01/28/15 10:25

Matrix: Filter

Date Received: 02/02/15 13:20

			Count	Total						
Other Detected			Uncert.	Uncert.	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Radionuclides	Result	Qualifier	(2σ+/-)	(2σ+/-)						
Other Detected	None						pCi/Sample	02/03/15 13:37	02/03/15 19:46	1
Radionuclide										

Client Sample ID: WAA-00-AF-FB-20150128

Lab Sample ID: 160-10333-6

Date Collected: 01/28/15 00:00

Matrix: Filter

Date Received: 02/02/15 13:20

Method: 9310 - Gross Alpha / Beta (GFPC)

			Count	Total						
			Uncert.	Uncert.	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Analyte	Result	Qualifier	(2σ+/-)	(2σ+/-)						
Gross Alpha	0.0974	U	0.182	0.182	10.0	0.328	pCi/Sample	02/03/15 13:35	02/03/15 20:51	1
Gross Beta	1.46	U	0.384	0.411	10.0	0.372	pCi/Sample	02/03/15 13:35	02/03/15 20:51	1

Method: GA-01-R - Cesium-137 & Other Gamma Emitters (GS)

			Count	Total						
			Uncert.	Uncert.	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Analyte	Result	Qualifier	(2σ+/-)	(2σ+/-)						
Cesium-137	0.000	U	4.02	4.02	20.0	9.68	pCi/Sample	02/03/15 13:37	02/03/15 19:41	1

			Count	Total						
			Uncert.	Uncert.	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Other Detected	Result	Qualifier	(2σ+/-)	(2σ+/-)						
Radionuclides	None						pCi/Sample	02/03/15 13:37	02/03/15 19:41	1
Other Detected										
Radionuclide										

HUG  
25 Feb 15

TestAmerica St. Louis



# QC Sample Results

Client: Tetra Tech EM Inc.  
Project/Site: West Lake Landfill - Filters

TestAmerica Job ID: 160-10333-2

## Method: 9310 - Gross Alpha / Beta (GFPC)

Lab Sample ID: MB 160-171848/1-A

Matrix: Filter

Analysis Batch: 171819

Client Sample ID: Method Blank

Prep Type: Total/NA

Prep Batch: 171848

Analyte	MB Result	MB Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Gross Alpha	-0.01722	U	0.124	0.124	10.0	0.297	pCi/Sample	02/03/15 13:35	02/03/15 19:22	1
Gross Beta	0.1664	U	0.221	0.221	10.0	0.370	pCi/Sample	02/03/15 13:35	02/03/15 19:22	1

Lab Sample ID: LCS 160-171848/2-A

Matrix: Filter

Analysis Batch: 171819

Client Sample ID: Lab Control Sample

Prep Type: Total/NA

Prep Batch: 171848

Analyte	Spike Added	LCS Result	LCS Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits
Gross Alpha	5.37	5.461		1.01	10.0	0.358	pCi/Samp	102	75 - 125

Lab Sample ID: LCSB 160-171848/3-A

Matrix: Filter

Analysis Batch: 171819

Client Sample ID: Lab Control Sample

Prep Type: Total/NA

Prep Batch: 171848

Analyte	Spike Added	LCSB Result	LCSB Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits
Gross Beta	17.9	18.32		2.19	10.0	0.372	pCi/Samp	103	75 - 125

Lab Sample ID: 160-10333-1 DU

Matrix: Filter

Analysis Batch: 171817

Client Sample ID: WAA-01-AF-PS-20150128

Prep Type: Total/NA

Prep Batch: 171848

Analyte	Sample Result	Sample Qual	DU Result	DU Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	RER	RER Limit
Gross Alpha	0.359		0.3520		0.250	10.0	0.324	pCi/Samp	0.01	1
Gross Beta	10.7		11.41		1.48	10.0	0.371	pCi/Samp	0.24	1

## Method: GA-01-R - Cesium-137 & Other Gamma Emitters (GS)

Lab Sample ID: MB 160-171851/1-A

Matrix: Filter

Analysis Batch: 171877

Client Sample ID: Method Blank

Prep Type: Total/NA

Prep Batch: 171851

Analyte	MB Result	MB Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Cesium-137	-3.554	U	24.9	24.9	20.0	15.3	pCi/Sample	02/03/15 13:37	02/03/15 18:42	1
Other Detected Radionuclides	MB Result	MB Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Other Detected Radionuclide	None						pCi/Sample	02/03/15 13:37	02/03/15 18:42	1

TestAmerica St. Louis

# QC Sample Results

Client: Tetra Tech EM Inc.  
Project/Site: West Lake Landfill - Filters

TestAmerica Job ID: 160-10333-2

## Method: GA-01-R - Cesium-137 & Other Gamma Emitters (GS) (Continued)

Lab Sample ID: LCS 160-171851/2-A  
Matrix: Filter  
Analysis Batch: 171879

Client Sample ID: Lab Control Sample  
Prep Type: Total/NA  
Prep Batch: 171851

Analyte	Spike Added	LCS Result	LCS Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits
Americium-241	32000	31400		3270		117	pCi/Samp	98	87 - 116
Cesium-137	11100	10780		1130	20.0	64.4	pCi/Samp	97	87 - 120
Cobalt-60	11700	11610		1170		40.7	pCi/Samp	99	87 - 115

Lab Sample ID: 160-10333-1 DU  
Matrix: Filter  
Analysis Batch: 171882

Client Sample ID: WAA-01-AF-PS-20150128  
Prep Type: Total/NA  
Prep Batch: 171851

Analyte	Sample Result	Sample Qual	DU Result	DU Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	RER	RER Limit
Cesium-137	-0.386	U	0.9008	U	3.92	20.0	7.21	pCi/Samp	0.17	1
Other Detected Radionuclides	Sample Result	Sample Qual	DU Result	DU Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	RER	RER Limit
Other Detected Radionuclide	None		None					pCi/Samp		

## QC Association Summary

Client: Tetra Tech EM Inc.  
Project/Site: West Lake Landfill - Filters

TestAmerica Job ID: 160-10333-2

### Rad

#### Prep Batch: 171848

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-10333-1	WAA-01-AF-PS-20150128	Total/NA	Filter	None	
160-10333-1 DU	WAA-01-AF-PS-20150128	Total/NA	Filter	None	
160-10333-2	WAA-02-AF-PS-20150128	Total/NA	Filter	None	
160-10333-3	WAA-03-AF-PS-20150128	Total/NA	Filter	None	
160-10333-4	WAA-04-AF-PS-20150128	Total/NA	Filter	None	
160-10333-5	WAA-05-AF-PS-20150128	Total/NA	Filter	None	
160-10333-6	WAA-00-AF-FB-20150128	Total/NA	Filter	None	
LCS 160-171848/2-A	Lab Control Sample	Total/NA	Filter	None	
LCSB 160-171848/3-A	Lab Control Sample	Total/NA	Filter	None	
MB 160-171848/1-A	Method Blank	Total/NA	Filter	None	

#### Prep Batch: 171851

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-10333-1	WAA-01-AF-PS-20150128	Total/NA	Filter	None	
160-10333-1 DU	WAA-01-AF-PS-20150128	Total/NA	Filter	None	
160-10333-2	WAA-02-AF-PS-20150128	Total/NA	Filter	None	
160-10333-3	WAA-03-AF-PS-20150128	Total/NA	Filter	None	
160-10333-4	WAA-04-AF-PS-20150128	Total/NA	Filter	None	
160-10333-5	WAA-05-AF-PS-20150128	Total/NA	Filter	None	
160-10333-6	WAA-00-AF-FB-20150128	Total/NA	Filter	None	
LCS 160-171851/2-A	Lab Control Sample	Total/NA	Filter	None	
MB 160-171851/1-A	Method Blank	Total/NA	Filter	None	

**Tetra Tech, Inc.**  
**DATA VALIDATION REPORT**  
**LEVEL II**

Site: West Lake Landfill Site, Bridgeton, Missouri

Laboratory: Pace Analytical Services, Inc. (Lenexa, Kansas)

Data Reviewer: Harry Ellis, Tetra Tech, Inc. (Tetra Tech)

Review Date: February 24, 2015

Sample Delivery Group (SDG): 60187128

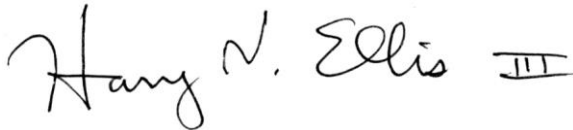
Sample Numbers: WAA-01-RV-PS-20150128, WAA-02-RV-PS-20150128,  
WAA-03-RV-PS-20150128, WAA-04-RV-PS-20150128,  
WAA-04-RV-DU-20150128, WAA-05-RV-PS-20150128, and  
WAA-00-RV-TB-20150128

Matrix / Number of Samples: 5 Air Samples, 1 Field Duplicate Sample, and 1 Trip Blank

The data were qualified according to the U.S. Environmental Protection Agency (EPA) Region 7 documents entitled "Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review" (9240.1-48), June 2008. In addition, the Tetra Tech document "Review of Data Packages from Subcontracted Laboratories" (February 2002) was used along with other criteria specified in the applicable methods.

The review was intended to identify problems and quality control (QC) deficiencies that were readily apparent from the summary data package. The following sections discuss any problems or deficiencies that were found, and data qualifications applied because of non-compliant QC. The data review was limited to the available field and laboratory QC information submitted with the project-specific data package.

I, Harry Ellis, certify that all data validation criteria outlined in the above-referenced documents were assessed, and any qualifications made to the data accorded with those documents.



24 February 2015

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Certified by Harry Ellis, Chemist

---

Date

## DATA VALIDATION QUALIFIERS

- U** — The analyte was not detected above the reported sample quantitation limit.
- J** — The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.
- UJ** — The analyte was not detected above the reported sample quantitation limit, which is estimated.
- R** — The sample results are rejected due to serious deficiencies in the ability to analyze the sample and meet QC criteria. Presence or absence of the analyte cannot be verified.

## **DATA ASSESSMENT**

Sample delivery group (SDG) 60187128 included five (5) environmental air (adsorbent tube) samples and two (2) QC samples (a field duplicate and a trip blank). Samples were analyzed for selected volatile organic compounds via EPA Air Method TO-17. The following summarizes the data validation that was performed.

### **VOLATILE ORGANIC COMPOUND ANALYSIS**

#### **I. Holding Time and Chain of Custody (COC) Requirements**

The samples were received by the laboratory and analyzed within the established holding time of 30 days from sample collection by tube to analysis. No data were qualified.

#### **II. Matrix Spike/Matrix Spike Duplicate (MS/MSD)**

MS/MSD analyses are not practical for air analyses. Satisfactory LCS and field duplicate sample analysis provided adequate data on precision and accuracy. No qualifications were applied.

#### **III. Blanks**

No analytes were detected in the laboratory (method) field blank. The field blank yielded a low concentration of m+p-xylenes. All other field samples yielded considerably higher concentrations so no qualifications were applied.

#### **IV. Laboratory Control Sample (LCS)**

All LCS results were within QC limits. No qualifications were applied.

#### **V. Surrogates**

All surrogate recoveries were within QC limits. No qualifications were applied.

#### **VI. Comments**

No analytes were detected in the field samples.

#### **VII. Overall Assessment of Data**

Overall data quality is acceptable, with no qualifications added. All data are usable as reported for their intended purposes.

February 13, 2015

Emily Fisher  
TETRA TECH EMI  
415 Oak  
Kansas City, MO 64106

RE: Project: WESTLAKE LANDFILL  
Pace Project No.: 60187128

Dear Emily Fisher:

Enclosed are the analytical results for sample(s) received by the laboratory on January 29, 2015. The results relate only to the samples included in this report. Results reported herein conform to the most current TNI standards and the laboratory's Quality Assurance Manual, where applicable, unless otherwise noted in the body of the report.

If you have any questions concerning this report, please feel free to contact me.

Sincerely,



Sherri Rosenstangle  
sherri.rosenstangle@pacelabs.com  
Project Manager

Enclosures



## REPORT OF LABORATORY ANALYSIS

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## CERTIFICATIONS

Project: WESTLAKE LANDFILL

Pace Project No.: 60187128

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### Minnesota Certification IDs

1700 Elm Street SE Suite 200, Minneapolis, MN 55414

A2LA Certification #: 2926.01

Alaska Certification #: UST-078

Alaska Certification #MN00064

Alabama Certification #40770

Arizona Certification #: AZ-0014

Arkansas Certification #: 88-0680

California Certification #: 01155CA

Colorado Certification #Pace

Connecticut Certification #: PH-0256

EPA Region 8 Certification #: 8TMS-L

Florida/NELAP Certification #: E87605

Guam Certification #: 14-008r

Georgia Certification #: 959

Georgia EPD #: Pace

Idaho Certification #: MN00064

Hawaii Certification #MN00064

Illinois Certification #: 200011

Indiana Certification#C-MN-01

Iowa Certification #: 368

Kansas Certification #: E-10167

Kentucky Dept of Envi. Protection - DW #90062

Kentucky Dept of Envi. Protection - WW #:90062

Louisiana DEQ Certification #: 3086

Louisiana DHH #: LA140001

Maine Certification #: 2013011

Maryland Certification #: 322

Michigan DEPH Certification #: 9909

Minnesota Certification #: 027-053-137

Mississippi Certification #: Pace

Montana Certification #: MT0092

Nevada Certification #: MN\_00064

Nebraska Certification #: Pace

New Jersey Certification #: MN-002

New York Certification #: 11647

North Carolina Certification #: 530

North Carolina State Public Health #: 27700

North Dakota Certification #: R-036

Ohio EPA #: 4150

Ohio VAP Certification #: CL101

Oklahoma Certification #: 9507

Oregon Certification #: MN200001

Oregon Certification #: MN300001

Pennsylvania Certification #: 68-00563

Puerto Rico Certification

Saipan (CNMI) #:MP0003

South Carolina #:74003001

Texas Certification #: T104704192

Tennessee Certification #: 02818

Utah Certification #: MN000642013-4

Virginia DGS Certification #: 251

Virginia/VELAP Certification #: Pace

Washington Certification #: C486

West Virginia Certification #: 382

West Virginia DHHR #:9952C

Wisconsin Certification #: 999407970

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## SAMPLE SUMMARY

Project: WESTLAKE LANDFILL

Pace Project No.: 60187128

Lab ID	Sample ID	Matrix	Date Collected	Date Received
60187128001	WAA-01-RV-PS-20150128	Air	01/28/15 14:02	01/29/15 09:35
60187128002	WAA-02-RV-PS-20150128	Air	01/28/15 13:21	01/29/15 09:35
60187128003	WAA-03-RV-PS-20150128	Air	01/28/15 13:39	01/29/15 09:35
60187128004	WAA-04-RV-PS-20150128	Air	01/28/15 13:53	01/29/15 09:35
60187128005	WAA-05-RV-PS-20150128	Air	01/28/15 13:29	01/29/15 09:35
60187128006	WAA-04-RV-DU-20150128	Air	01/28/15 13:53	01/29/15 09:35
60187128007	WAA-00-RV-TB-20150128	Air	01/28/15 14:09	01/29/15 09:35

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## SAMPLE ANALYTE COUNT

Project: WESTLAKE LANDFILL

Pace Project No.: 60187128

Lab ID	Sample ID	Method	Analysts	Analytes Reported	Laboratory
60187128001	WAA-01-RV-PS-20150128	TO-17M	RTP	13	PASI-M
60187128002	WAA-02-RV-PS-20150128	TO-17M	RTP	13	PASI-M
60187128003	WAA-03-RV-PS-20150128	TO-17M	RTP	13	PASI-M
60187128004	WAA-04-RV-PS-20150128	TO-17M	RTP	13	PASI-M
60187128005	WAA-05-RV-PS-20150128	TO-17M	RTP	13	PASI-M
60187128006	WAA-04-RV-DU-20150128	TO-17M	RTP	13	PASI-M
60187128007	WAA-00-RV-TB-20150128	TO-17M	RTP	13	PASI-M

## REPORT OF LABORATORY ANALYSIS

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## ANALYTICAL RESULTS

Project: WESTLAKE LANDFILL  
Pace Project No: 60187128

Sample: WAA-01-RV-PS-20150128		Lab ID: 60187128001	Collected: 01/28/15 14:02	Received: 01/29/15 09:35	Matrix: Air			
Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No	Qual
TO17M VOC MS AIR Passive		Analytical Method: TO-17M Preparation Method: TO-17M						
cis-1,2-Dichloroethene	ND	ug/m3	0.074	1	02/06/15 06:41	02/06/15 21:51	156-59-2	
trans-1,2-Dichloroethene	ND	ug/m3	0.074	1	02/06/15 06:41	02/06/15 21:51	156-60-5	
Ethylbenzene	0.32	ug/m3	0.074	1	02/06/15 06:41	02/06/15 21:51	100-41-4	
Isopropylbenzene (Cumene)	ND	ug/m3	0.19	1	02/06/15 06:41	02/06/15 21:51	98-82-8	
Methyl-tert-butyl ether	ND	ug/m3	0.074	1	02/06/15 06:41	02/06/15 21:51	1634-04-4	
Tetrachloroethene	0.27	ug/m3	0.19	1	02/06/15 06:41	02/06/15 21:51	127-18-4	
Trichloroethene	ND	ug/m3	0.19	1	02/06/15 06:41	02/06/15 21:51	79-01-6	
1,2,4-Trimethylbenzene	0.26	ug/m3	0.19	1	02/06/15 06:41	02/06/15 21:51	95-63-6	
1,3,5-Trimethylbenzene	ND	ug/m3	0.19	1	02/06/15 06:41	02/06/15 21:51	108-67-8	
Vinyl chloride	ND	ug/m3	0.074	1	02/06/15 06:41	02/06/15 21:51	75-01-4	
m&p-Xylene	0.98	ug/m3	0.15	1	02/06/15 06:41	02/06/15 21:51	179601-23-1	
o-Xylene	0.34	ug/m3	0.074	1	02/06/15 06:41	02/06/15 21:51	95-47-6	
<b>Surrogates</b>								
Chlorobenzene-d5 (S)	107 %			1	02/06/15 06:41	02/06/15 21:51	3114-55-4	

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24 February 2015

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## ANALYTICAL RESULTS

Project: WESTLAKE LANDFILL  
Pace Project No.: 60187128

Sample: WAA-02-RV-PS-20150128		Lab ID: 60187128002	Collected: 01/28/15 13:21	Received: 01/29/15 09:35	Matrix: Air			
Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
<b>TO17M VOC MS AIR Passive</b>		Analytical Method: TO-17M Preparation Method: TO-17M						
cis-1,2-Dichloroethene	ND	ug/m3	0.074	1	02/06/15 06:41	02/06/15 22:22	156-59-2	
trans-1,2-Dichloroethene	ND	ug/m3	0.074	1	02/06/15 06:41	02/06/15 22:22	156-60-5	
Ethylbenzene	0.31	ug/m3	0.074	1	02/06/15 06:41	02/06/15 22:22	100-41-4	
Isopropylbenzene (Cumene)	ND	ug/m3	0.19	1	02/06/15 06:41	02/06/15 22:22	98-82-8	
Methyl-tert-butyl ether	ND	ug/m3	0.074	1	02/06/15 06:41	02/06/15 22:22	1634-04-4	
Tetrachloroethene	0.46	ug/m3	0.19	1	02/06/15 06:41	02/06/15 22:22	127-18-4	
Trichloroethene	0.51	ug/m3	0.19	1	02/06/15 06:41	02/06/15 22:22	79-01-6	
1,2,4-Trimethylbenzene	0.27	ug/m3	0.19	1	02/06/15 06:41	02/06/15 22:22	95-63-6	
1,3,5-Trimethylbenzene	ND	ug/m3	0.19	1	02/06/15 06:41	02/06/15 22:22	108-67-8	
Vinyl chloride	ND	ug/m3	0.074	1	02/06/15 06:41	02/06/15 22:22	75-01-4	
m&p-Xylene	0.96	ug/m3	0.15	1	02/06/15 06:41	02/06/15 22:22	179601-23-1	
o-Xylene	0.33	ug/m3	0.074	1	02/06/15 06:41	02/06/15 22:22	95-47-6	
<b>Surrogates</b>								
Chlorobenzene-d5 (S)	106	%		1	02/06/15 05:41	02/06/15 22:22	3114-55-4	

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## ANALYTICAL RESULTS

Project WESTLAKE LANDFILL

Pace Project No.: 60187128

Sample: WAA-03-RV-PS-20150128 Lab ID: 60187128003 Collected: 01/28/15 13:39 Received: 01/29/15 09:35 Matrix: Air

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
TO17M VOC MS AIR Passive Analytical Method: TO-17M Preparation Method: TO-17M								
cis-1,2-Dichloroethene	ND	ug/m3	0.074	1	02/06/15 06:41	02/06/15 22:53	156-59-2	
trans-1,2-Dichloroethene	ND	ug/m3	0.074	1	02/06/15 06:41	02/06/15 22:53	156-60-5	
Ethylbenzene	0.29	ug/m3	0.074	1	02/06/15 06:41	02/06/15 22:53	100-41-4	
Isopropylbenzene (Cumene)	ND	ug/m3	0.19	1	02/06/15 06:41	02/06/15 22:53	98-82-8	
Methyl-tert-butyl ether	ND	ug/m3	0.074	1	02/06/15 06:41	02/06/15 22:53	1634-04-4	
Tetrachloroethene	ND	ug/m3	0.19	1	02/06/15 06:41	02/06/15 22:53	127-18-4	
Trichloroethene	ND	ug/m3	0.19	1	02/06/15 06:41	02/06/15 22:53	79-01-6	
1,2,4-Trimethylbenzene	0.32	ug/m3	0.19	1	02/06/15 06:41	02/06/15 22:53	95-63-6	
1,3,5-Trimethylbenzene	ND	ug/m3	0.19	1	02/06/15 06:41	02/06/15 22:53	108-67-8	
Vinyl chloride	ND	ug/m3	0.074	1	02/06/15 06:41	02/06/15 22:53	75-01-4	
m&p-Xylene	0.89	ug/m3	0.15	1	02/06/15 06:41	02/06/15 22:53	179601-23-1	
o-Xylene	0.30	ug/m3	0.074	1	02/06/15 06:41	02/06/15 22:53	95-47-6	
<b>Surrogates</b>								
Chlorobenzene-d5 (S)	113	%		1	02/06/15 06:41	02/06/15 22:53	3114-55-4	

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## ANALYTICAL RESULTS

Project: WESTLAKE LANDFILL

Pace Project No.: 60187128

Sample: WAA-04-RV-PS-20150128		Lab ID: 60187128004	Collected: 01/28/15 13:53	Received: 01/29/15 09:35	Matrix: Air			
Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No	Qual
TO17M VOC MS AIR Passive		Analytical Method: TO-17M Preparation Method: TO-17M						
cis-1,2-Dichloroethene	ND	ug/m3	0.074	1	02/06/15 06:41	02/06/15 23:25	156-59-2	
trans-1,2-Dichloroethene	ND	ug/m3	0.074	1	02/06/15 06:41	02/06/15 23:25	156-60-5	
Ethylbenzene	0.31	ug/m3	0.074	1	02/06/15 06:41	02/06/15 23:25	100-41-4	
Isopropylbenzene (Cumene)	ND	ug/m3	0.19	1	02/06/15 06:41	02/06/15 23:25	98-82-8	
Methyl-tert-butyl ether	ND	ug/m3	0.074	1	02/06/15 06:41	02/06/15 23:25	1634-04-4	
Tetrachloroethene	ND	ug/m3	0.19	1	02/06/15 06:41	02/06/15 23:25	127-18-4	
Trichloroethene	ND	ug/m3	0.19	1	02/06/15 06:41	02/06/15 23:25	79-01-6	
1,2,4-Trimethylbenzene	0.35	ug/m3	0.19	1	02/06/15 06:41	02/06/15 23:25	95-63-6	
1,3,5-Trimethylbenzene	ND	ug/m3	0.19	1	02/06/15 06:41	02/06/15 23:25	108-67-8	
Vinyl chloride	ND	ug/m3	0.074	1	02/06/15 06:41	02/06/15 23:25	75-01-4	
m&p-Xylene	0.91	ug/m3	0.15	1	02/06/15 06:41	02/06/15 23:25	179601-23-1	
o-Xylene	0.31	ug/m3	0.074	1	02/06/15 06:41	02/06/15 23:25	95-47-6	
<b>Surrogates</b>								
Chlorobenzene-d5 (S)	109 %			1	02/06/15 06:41	02/06/15 23:25	3114-55-4	

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## ANALYTICAL RESULTS

Project: WESTLAKE LANDFILL

Pace Project No.: 60187128

Sample: WAA-05-RV-PS-20150128		Lab ID: 60187128005	Collected: 01/28/15 13:29	Received: 01/29/15 09:35	Matrix: Air			
Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
<b>TO17M VOC MS AIR Passive</b>		Analytical Method: TO-17M Preparation Method: TO-17M						
cis-1,2-Dichloroethene	ND	ug/m3	0.074	1	02/06/15 06:41	02/06/15 23:57	156-59-2	
trans-1,2-Dichloroethene	ND	ug/m3	0.074	1	02/06/15 06:41	02/06/15 23:57	156-60-5	
Ethylbenzene	0.37	ug/m3	0.074	1	02/06/15 06:41	02/06/15 23:57	100-41-4	
Isopropylbenzene (Cumene)	ND	ug/m3	0.19	1	02/06/15 06:41	02/06/15 23:57	98-82-8	
Methyl-tert-butyl ether	ND	ug/m3	0.074	1	02/06/15 06:41	02/06/15 23:57	1634-04-4	
Tetrachloroethene	0.23	ug/m3	0.19	1	02/06/15 06:41	02/06/15 23:57	127-18-4	
Trichloroethene	ND	ug/m3	0.19	1	02/06/15 06:41	02/06/15 23:57	79-01-6	
1,2,4-Trimethylbenzene	0.45	ug/m3	0.19	1	02/06/15 06:41	02/06/15 23:57	95-63-6	
1,3,5-Trimethylbenzene	ND	ug/m3	0.19	1	02/06/15 06:41	02/06/15 23:57	108-67-8	
Vinyl chloride	ND	ug/m3	0.074	1	02/06/15 06:41	02/06/15 23:57	75-01-4	
m&p-Xylene	1.1	ug/m3	0.15	1	02/06/15 06:41	02/06/15 23:57	179601-23-1	
o-Xylene	0.39	ug/m3	0.074	1	02/06/15 06:41	02/06/15 23:57	95-47-6	
<b>Surrogates</b>								
Chlorobenzene-d5 (S)	111	%		1	02/06/15 06:41	02/06/15 23:57	3114-55-4	

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## ANALYTICAL RESULTS

Project: WESTLAKE LANDFILL

Pace Project No.: 60187128

Sample: WAA-04-RV-DU-20150128 Lab ID: 60187128006 Collected: 01/28/15 13:53 Received: 01/29/15 09:35 Matrix: Air

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
TO17M VOC MS AIR Passive Analytical Method: TO-17M Preparation Method: TO-17M								
cis-1,2-Dichloroethene	ND	ug/m3	0.074	1	02/06/15 06:41	02/07/15 00:29	156-59-2	
trans-1,2-Dichloroethene	ND	ug/m3	0.074	1	02/06/15 06:41	02/07/15 00:29	156-80-5	
Ethylbenzene	0.28	ug/m3	0.074	1	02/06/15 06:41	02/07/15 00:29	100-41-4	
Isopropylbenzene (Cumene)	ND	ug/m3	0.19	1	02/06/15 06:41	02/07/15 00:29	98-82-8	
Methyl-tert-butyl ether	ND	ug/m3	0.074	1	02/06/15 06:41	02/07/15 00:29	1634-04-4	
Tetrachloroethene	ND	ug/m3	0.19	1	02/06/15 06:41	02/07/15 00:29	127-18-4	
Trichloroethene	ND	ug/m3	0.19	1	02/06/15 06:41	02/07/15 00:29	79-01-6	
1,2,4-Trimethylbenzene	0.25	ug/m3	0.19	1	02/06/15 06:41	02/07/15 00:29	95-63-6	
1,3,5-Trimethylbenzene	ND	ug/m3	0.19	1	02/06/15 06:41	02/07/15 00:29	108-67-8	
Vinyl chloride	ND	ug/m3	0.074	1	02/06/15 06:41	02/07/15 00:29	75-01-4	
m&p-Xylene	0.84	ug/m3	0.15	1	02/06/15 06:41	02/07/15 00:29	179601-23-1	
o-Xylene	0.29	ug/m3	0.074	1	02/06/15 06:41	02/07/15 00:29	95-47-6	
<b>Surrogates</b>								
Chlorobenzene-d5 (S)	111	%		1	02/06/15 06:41	02/07/15 00:29	3114-55-4	

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## ANALYTICAL RESULTS

Project: WESTLAKE LANDFILL

Pace Project No.: 60187128

Sample: WAA-00-RV-TB-20150128    Lab ID: 60187128007    Collected: 01/28/15 14:09    Received: 01/29/15 09:35    Matrix: Air								
Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
TO17M VOC MS AIR Passive    Analytical Method: TO-17M    Preparation Method: TO-17M								
cis-1,2-Dichloroethene	ND	ug/m3	0.074	1	02/06/15 06:41	02/07/15 01:01	156-59-2	
trans-1,2-Dichloroethene	ND	ug/m3	0.074	1	02/06/15 06:41	02/07/15 01:01	156-60-5	
Ethylbenzene	ND	ug/m3	0.074	1	02/06/15 06:41	02/07/15 01:01	100-41-4	
Isopropylbenzene (Cumene)	ND	ug/m3	0.19	1	02/06/15 06:41	02/07/15 01:01	98-82-8	
Methyl-tert-butyl ether	ND	ug/m3	0.074	1	02/06/15 06:41	02/07/15 01:01	1634-04-4	
Tetrachloroethene	ND	ug/m3	0.19	1	02/06/15 06:41	02/07/15 01:01	127-18-4	
Trichloroethene	ND	ug/m3	0.19	1	02/06/15 06:41	02/07/15 01:01	79-01-6	
1,2,4-Trimethylbenzene	ND	ug/m3	0.19	1	02/06/15 06:41	02/07/15 01:01	95-63-6	
1,3,5-Trimethylbenzene	ND	ug/m3	0.19	1	02/06/15 06:41	02/07/15 01:01	108-67-8	
Vinyl chloride	ND	ug/m3	0.074	1	02/06/15 06:41	02/07/15 01:01	75-01-4	
m&p-Xylene	0.21	ug/m3	0.15	1	02/06/15 06:41	02/07/15 01:01	179601-23-1	
o-Xylene	ND	ug/m3	0.074	1	02/06/15 06:41	02/07/15 01:01	95-47-6	
<b>Surrogates</b>								
Chlorobenzene-d5 (S)	105	%		1	02/06/15 06:41	02/07/15 01:01	3114-55-4	

## REPORT OF LABORATORY ANALYSIS

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## QUALITY CONTROL DATA

Project: WESTLAKE LANDFILL  
Pace Project No.: 60187128

QC Batch: AIR/22462 Analysis Method: TO-17M  
QC Batch Method: TO-17M Analysis Description: TO17 MSS AIR  
Associated Lab Samples: 60187128001, 60187128002, 60187128003, 60187128004, 60187128005, 60187128006, 60187128007

METHOD BLANK: 1896384 Matrix: Air  
Associated Lab Samples: 60187128001, 60187128002, 60187128003, 60187128004, 60187128005, 60187128006, 60187128007

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
1,2,4-Trimethylbenzene	ug/m3	ND	0.19	02/06/15 15:15	
1,3,5-Trimethylbenzene	ug/m3	ND	0.19	02/06/15 15:15	
cis-1,2-Dichloroethene	ug/m3	ND	0.074	02/06/15 15:15	
Ethylbenzene	ug/m3	ND	0.074	02/06/15 15:15	
Isopropylbenzene (Cumene)	ug/m3	ND	0.19	02/06/15 15:15	
m&p-Xylene	ug/m3	ND	0.15	02/06/15 15:15	
Methyl-tert-butyl ether	ug/m3	ND	0.074	02/06/15 15:15	
o-Xylene	ug/m3	ND	0.074	02/06/15 15:15	
Tetrachloroethene	ug/m3	ND	0.19	02/06/15 15:15	
trans-1,2-Dichloroethene	ug/m3	ND	0.074	02/06/15 15:15	
Trichloroethene	ug/m3	ND	0.19	02/06/15 15:15	
Vinyl chloride	ug/m3	ND	0.074	02/06/15 15:15	
Chlorobenzene-d5 (S)	%	97		02/06/15 15:15	

LABORATORY CONTROL SAMPLE: 1896385

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
1,2,4-Trimethylbenzene	ug/m3	118	127	108	70-130	
1,3,5-Trimethylbenzene	ug/m3	118	123	105	70-130	
cis-1,2-Dichloroethene	ug/m3	79.6	87.5	110	70-130	
Ethylbenzene	ug/m3	88.5	90.3	102	70-130	
Isopropylbenzene (Cumene)	ug/m3	98.4	105	107	70-130	
m&p-Xylene	ug/m3	85.3	90.7	106	70-130	
Methyl-tert-butyl ether	ug/m3	63.1	81.7	129	70-130	
o-Xylene	ug/m3	92.1	96.4	105	70-130	
Tetrachloroethene	ug/m3	139	147	106	70-130	
trans-1,2-Dichloroethene	ug/m3	79.6	89.3	112	70-130	
Trichloroethene	ug/m3	104	117	113	70-130	
Vinyl chloride	ug/m3	51.5	54.9	107	70-130	
Chlorobenzene-d5 (S)	%			101		

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

## REPORT OF LABORATORY ANALYSIS

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## QUALIFIERS

Project: WESTLAKE LANDFILL

Pace Project No.: 60187128

---

### DEFINITIONS

DF - Dilution Factor, if reported, represents the factor applied to the reported data due to changes in sample preparation, dilution of the sample aliquot, or moisture content.

ND - Not Detected at or above adjusted reporting limit.

J - Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit.

MDL - Adjusted Method Detection Limit.

PQL - Practical Quantitation Limit.

RL - Reporting Limit.

S - Surrogate

1,2-Diphenylhydrazine (8270 listed analyte) decomposes to Azobenzene.

Consistent with EPA guidelines, unrounded data are displayed and have been used to calculate % recovery and RPD values.

LCS(D) - Laboratory Control Sample (Duplicate)

MS(D) - Matrix Spike (Duplicate)

DUP - Sample Duplicate

RPD - Relative Percent Difference

NC - Not Calculable.

SG - Silica Gel - Clean-Up

U - Indicates the compound was analyzed for, but not detected.

N-Nitrosodiphenylamine decomposes and cannot be separated from Diphenylamine using Method 8270. The result reported for each analyte is a combined concentration.

Pace Analytical is TNI accredited. Contact your Pace PM for the current list of accredited analytes.

TNI - The NELAC Institute.

### LABORATORIES

PASI-M Pace Analytical Services - Minneapolis

## REPORT OF LABORATORY ANALYSIS

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## QUALITY CONTROL DATA CROSS REFERENCE TABLE


Project: WESTLAKE LANDFILL

Pace Project No.: 60187128

Lab ID	Sample ID	QC Batch Method	QC Batch	Analytical Method	Analytical Batch
60187128001	WAA-01-RV-PS-20150128	TO-17M	AIR/22462	TO-17M	AIR/22463
60187128002	WAA-02-RV-PS-20150128	TO-17M	AIR/22462	TO-17M	AIR/22463
60187128003	WAA-03-RV-PS-20150128	TO-17M	AIR/22462	TO-17M	AIR/22463
60187128004	WAA-04-RV-PS-20150128	TO-17M	AIR/22462	TO-17M	AIR/22463
60187128005	WAA-05-RV-PS-20150128	TO-17M	AIR/22462	TO-17M	AIR/22463
60187128006	WAA-04-RV-DU-20150128	TO-17M	AIR/22462	TO-17M	AIR/22463
60187128007	WAA-00-RV-TB-20150128	TO-17M	AIR/22462	TO-17M	AIR/22463

## REPORT OF LABORATORY ANALYSIS

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	Document Name: Air Sample Condition Upon Receipt	Document Revised: 26Dec2013 Page 1 of 1
	Document No.: F-MN-A-106-rev.09	Issuing Authority: Pace Minnesota Quality Office

**Air Sample Condition  
Upon Receipt**

Client Name:

Pace KS

Project

**WO# : 60187128**



60187128

Courier: ☒ Fed Ex ☐ UPS ☐ USPS ☐ Client  
☐ Commercial ☐ Pace ☐ Other: \_\_\_\_\_

Tracking Number: 772746587678

Custody Seal on Cooler/Box Present? ☒ Yes ☐ No

Seals Intact? ☒ Yes ☐ No

Optional: Proj. Due Date: \_\_\_\_\_ Proj. Name: \_\_\_\_\_

Packing Material: ☒ Bubble Wrap ☐ Bubble Bags ☐ Foam ☐ None ☐ Other: \_\_\_\_\_

Temp Blank rec: ☒ Yes ☐ No

Temp. (TO17 and TO13 samples only) (°C): 5.2 Corrected Temp (°C): 5.3

Thermom. Used: ☒ B88A912167504 ☐ B88A9132521491

☐ 72337080 ☐ 80512447

Temp should be above freezing to 6°C Correction Factor: +0.1

Date & Initials of Person Examining Contents: 12/29/15

Type of Ice Received ☐ Blue ☒ Wet ☐ None

Comments:

Chain of Custody Present?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	1.
Chain of Custody Filled Out?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	2.
Chain of Custody Relinquished?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	3.
Sampler Name and/or Signature on COC?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	4.
Samples Arrived within Hold Time?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	5.
Short Hold Time Analysis (<72 hr)?	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> N/A	6.
Rush Turn Around Time Requested?	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> N/A	7.
Sufficient Volume?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	8.
Correct Containers Used?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	9.
-Pace Containers Used?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	
Containers Intact?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	10.
Media: <u>TO17 Passive</u>		11.
Sample Labels Match COC?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	12.

Canisters		Flow Controllers		Stand Alone G	
Sample Number	Can ID	Sample Number	Can ID	Sample Number	Can ID

CLIENT NOTIFICATION/RESOLUTION

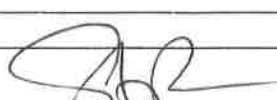
Field Data Required? ☐ Yes ☐ No

Person Contacted: \_\_\_\_\_

Date/Time: \_\_\_\_\_

Comments/Resolution: \_\_\_\_\_

Project Manager Review:



Date: 1.29.15

Note: Whenever there is a discrepancy affecting North Carolina compliance samples, a copy of this form will be sent to the North Carolina DEHNR Certification Office (i.e. out of hold, incorrect preservative, out of temp, incorrect containers)



**Tetra Tech, Inc.**  
**DATA VALIDATION REPORT**  
**LEVEL II**

Site: West Lake Landfill Site, Bridgeton, Missouri

Laboratory: ALS Environmental (Simi Valley, California)

Data Reviewer: Harry Ellis, Tetra Tech, Inc. (Tetra Tech)

Review Date: February 25, 2015

Sample Delivery Group (SDG): P15000232

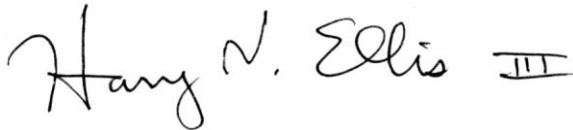
Sample Numbers: WAA-01-RH-PS-20150119, WAA-02-RH-PS-20150119, WAA-03-RH-PS-20150119, WAA-04-RH-PS-20150119, WAA-04-RH-DU-20150119, WAA-05-RH-PS-20150119, and WAA-00-RH-TB-20150119

Matrix / Number of Samples: 5 Air Samples, 1 Field Duplicate Sample, and 1 Trip Blank

The data were qualified according to the U.S. Environmental Protection Agency (EPA) Region 7 documents entitled "Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review" (9240.1-48), June 2008. In addition, the Tetra Tech document "Review of Data Packages from Subcontracted Laboratories" (February 2002) was used along with other criteria specified in the applicable methods.

The review was intended to identify problems and quality control (QC) deficiencies that were readily apparent from the summary data package. The following sections discuss any problems or deficiencies that were found, and data qualifications applied because of non-compliant QC. The data review was limited to the available field and laboratory QC information submitted with the project-specific data package.

I, Harry Ellis, certify that all data validation criteria outlined in the above-referenced documents were assessed, and any qualifications made to the data accorded with those documents.



25 February 2015

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Certified by Harry Ellis, Chemist

---

Date

## DATA VALIDATION QUALIFIERS

- U** — The analyte was not detected above the reported sample quantitation limit.
- J** — The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.
- UJ** — The analyte was not detected above the reported sample quantitation limit, which is estimated.
- R** — The sample results are rejected due to serious deficiencies in the ability to analyze the sample and meet QC criteria. Presence or absence of the analyte cannot be verified.



## **DATA ASSESSMENT**

Sample delivery group (SDG) P1500232 included five (5) environmental air (Radiello™ adsorbent tube) samples and two (2) QC samples (a field duplicate and a trip blank). Samples were analyzed for hydrogen sulfide via the laboratory's implementation of the manufacturer's method. The following summarizes the data validation that was performed.

### **VOLATILE ORGANIC COMPOUND ANALYSIS**

#### **I. Holding Time and Chain of Custody (COC) Requirements**

The samples were received by the laboratory and analyzed within the accepted holding time of 30 days from sample collection by tube to analysis. No data were qualified.

#### **II. Matrix Spike/Matrix Spike Duplicate (MS/MSD)**

MS/MSD analyses are not practical for air analyses. Satisfactory LCS and field duplicate sample analysis provided adequate data on precision and accuracy. No qualifications were applied.

#### **III. Blanks**

No analytes were detected in the laboratory (method) and field blanks. No qualifications were applied.

#### **IV. Laboratory Control Sample (LCS)**

All results for the duplicate LCS were within QC limits.

#### **V. Surrogates**

Surrogates are not used in this analysis.

#### **VI. Comments**

All detected results in the field samples were less than the sample reporting limits, which correspond to the lowest calibration standard. The laboratory correctly qualified these results as estimated and flagged them "J". All detected results, including the field duplicate pair, were quite similar.

#### **VII. Overall Assessment of Data**

Overall data quality is acceptable, with no qualifications added. All data are usable as reported for their intended purposes.



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2655 Park Center Dr., Suite A  
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[www.alsglobal.com](http://www.alsglobal.com)

## LABORATORY REPORT

January 30, 2015

Rob Monnig  
Tetra Tech, Incorporated  
415 Oak Street  
Kansas City, MO 64106

**RE: West Lake Landfill / 103X9025140058**

Dear Rob:

Enclosed are the results of the samples submitted to our laboratory on January 21, 2015. For your reference, these analyses have been assigned our service request number P1500232.

All analyses were performed according to our laboratory's NELAP and DoD-ELAP-approved quality assurance program. The test results meet requirements of the current NELAP and DoD-ELAP standards, where applicable, and except as noted in the laboratory case narrative provided. For a specific list of NELAP and DoD-ELAP-accredited analytes, refer to the certifications section at [www.alsglobal.com](http://www.alsglobal.com). Results are intended to be considered in their entirety and apply only to the samples analyzed and reported herein.

If you have any questions, please call me at (805) 526-7161.

Respectfully submitted,

**ALS | Environmental**

By Sue Anderson at 11:47 am, Jan 30, 2015

Sue Anderson  
Project Manager



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Simi Valley, CA 93065  
T: +1 805 526 7161  
F: +1 805 526 7270  
[www.alsglobal.com](http://www.alsglobal.com)

Client: Tetra Tech, Incorporated  
Project: West Lake Landfill / 103X9025140058

Service Request No: P1500232

---

## CASE NARRATIVE

The samples were received intact under chain of custody on January 21, 2015 and were stored in accordance with the analytical method requirements. Please refer to the sample acceptance check form for additional information. The results reported herein are applicable only to the condition of the samples at the time of sample receipt.

### Hydrogen Sulfide in Air (H<sub>2</sub>S) Analysis

The samples were prepared in accordance with CAS AQL 110 for hydrogen sulfide in air and analyzed by colorimetric method using a spectrophotometer. This method is not included on the laboratory's NELAP, DoD-ELAP, or AIHA-LAP scope of accreditation.

---

*The results of analyses are given in the attached laboratory report. All results are intended to be considered in their entirety, and ALS Environmental (ALS) is not responsible for utilization of less than the complete report.*

*Use of ALS Environmental (ALS)'s Name. Client shall not use ALS's name or trademark in any marketing or reporting materials, press releases or in any other manner ("Materials") whatsoever and shall not attribute to ALS any test result, tolerance or specification derived from ALS's data ("Attribution") without ALS's prior written consent, which may be withheld by ALS for any reason in its sole discretion. To request ALS's consent, Client shall provide copies of the proposed Materials or Attribution and describe in writing Client's proposed use of such Materials or Attribution. If ALS has not provided written approval of the Materials or Attribution within ten (10) days of receipt from Client, Client's request to use ALS's name or trademark in any Materials or Attribution shall be deemed denied. ALS may, in its discretion, reasonably charge Client for its time in reviewing Materials or Attribution requests. Client acknowledges and agrees that the unauthorized use of ALS's name or trademark may cause ALS to incur irreparable harm for which the recovery of money damages will be inadequate. Accordingly, Client acknowledges and agrees that a violation shall justify preliminary injunctive relief. For questions contact the laboratory.*



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ALS Environmental – Simi Valley

CERTIFICATIONS, ACCREDITATIONS, AND REGISTRATIONS

Agency	Web Site	Number
AIHA	<a href="http://www.aihaaccreditedlabs.org">http://www.aihaaccreditedlabs.org</a>	101661
Arizona DHS	<a href="http://www.azdhs.gov/lab/license/env.htm">http://www.azdhs.gov/lab/license/env.htm</a>	AZ0694
DoD ELAP	<a href="http://www.pjlabs.com/search-accredited-labs">http://www.pjlabs.com/search-accredited-labs</a>	L14-2
Florida DOH (NELAP)	<a href="http://www.doh.state.fl.us/lab/EnvLabCert/WaterCert.htm">http://www.doh.state.fl.us/lab/EnvLabCert/WaterCert.htm</a>	E871020
Maine DHHS	<a href="http://www.maine.gov/dhhs/mecdc/environmental-health/water/dwp-services/labcert/labcert.htm">http://www.maine.gov/dhhs/mecdc/environmental-health/water/dwp-services/labcert/labcert.htm</a>	2014025
Minnesota DOH (NELAP)	<a href="http://www.health.state.mn.us/accreditation">http://www.health.state.mn.us/accreditation</a>	838341
New Jersey DEP (NELAP)	<a href="http://www.nj.gov/dep/oqa/">http://www.nj.gov/dep/oqa/</a>	CA009
New York DOH (NELAP)	<a href="http://www.wadsworth.org/labcert/elap/elap.html">http://www.wadsworth.org/labcert/elap/elap.html</a>	11221
Oregon PHD (NELAP)	<a href="http://public.health.oregon.gov/LaboratoryServices/EnvironmentalLaboratoryAccreditation/Pages/index.aspx">http://public.health.oregon.gov/LaboratoryServices/EnvironmentalLaboratoryAccreditation/Pages/index.aspx</a>	CA200007
Pennsylvania DEP	<a href="http://www.depweb.state.pa.us/labs">http://www.depweb.state.pa.us/labs</a>	68-03307 (Registration)
Texas CEQ (NELAP)	<a href="http://www.tceq.texas.gov/field/qa/env_lab_accreditation.html">http://www.tceq.texas.gov/field/qa/env_lab_accreditation.html</a>	T104704413-14-5
Utah DOH (NELAP)	<a href="http://www.health.utah.gov/lab/labimp/certification/index.html">http://www.health.utah.gov/lab/labimp/certification/index.html</a>	CA01627201 4-4
Washington DOE	<a href="http://www.ecy.wa.gov/programs/eap/labs/lab-accreditation.html">http://www.ecy.wa.gov/programs/eap/labs/lab-accreditation.html</a>	C946

Analyses were performed according to our laboratory's NELAP and DoD-ELAP approved quality assurance program. A complete listing of specific NELAP and DoD-ELAP certified analytes can be found in the certifications section at [www.alsglobal.com](http://www.alsglobal.com), or at the accreditation body's website.

Each of the certifications listed above have an explicit Scope of Accreditation that applies to specific matrices/methods/analytes; therefore, please contact the laboratory for information corresponding to a particular certification.

## ALS ENVIRONMENTAL

### DETAIL SUMMARY REPORT

Client: Tetra Tech, Incorporated  
Project ID: West Lake Landfill / 103X9025140058

Service Request: P1500232

Date Received: 1/21/2015  
Time Received: 10:05

CAS AQL 110 - H2S Air

Client Sample ID	Lab Code	Matrix	Date Collected	Time Collected	
WAA-01-RH-PS-20150119	P1500232-001	Air	1/19/2015	14:01	X
WAA-02-RH-PS-20150119	P1500232-002	Air	1/19/2015	13:14	X
WAA-03-RH-PS-20150119	P1500232-003	Air	1/19/2015	13:40	X
WAA-04-RH-PS-20150119	P1500232-004	Air	1/19/2015	13:52	X
WAA-05-RH-PS-20150119	P1500232-005	Air	1/19/2015	13:20	X
WAA-04-RH-DU-20150119	P1500232-006	Air	1/19/2015	13:52	X
WAA-00-RH-TB-20150119	P1500232-007	Air	1/19/2015	13:00	X

# Radiello - Chain of Custody Record & Analytical Service Request

Page 1 of 1



2655 Park Center Drive, Suite A  
Simi Valley, California 93065  
Phone (805) 526-7161  
Fax (805) 526-7270

Requested Turnaround Time in Business Days (Surcharges) please circle 1 Day (100%) 2 Day (75%) 3 Day (50%) 4 Day (35%) 5 Day (25%) 10 Day-Standard							ALS Project No. <b>P1580232</b>	
Company Name & Address (Reporting Information) <b>Tetra Tech 415 Oak Street, Kansas City, MO 64106</b>				Project Name <b>West Lake Landfill</b>		ALS Contact: <b>Sue Anderson</b>		
				Project Number <b>103X9025140058</b>		Analysis: (e.g. NO <sub>2</sub> , SO <sub>2</sub> , O <sub>3</sub> , VOCs, Aldehyde, Ammonia)		
Project Manager <b>Rob Monnig (816-412-1775) / Dave Kinroth (314-517-6798)</b>				P.O. # / Credit Card / Billing Information <b>PO 1111500</b>		<div style="display: flex; align-items: center;"> <div style="writing-mode: vertical-rl; transform: rotate(180deg);">Hydrogen Sulfide</div> <div style="margin-left: 20px;"> <div style="border: 1px solid black; width: 100px; height: 100px; margin-bottom: 5px;"></div> <div style="border: 1px solid black; width: 100px; height: 100px; margin-bottom: 5px;"></div> <div style="border: 1px solid black; width: 100px; height: 100px;"></div> </div> </div>		
Phone <b>816-412-1775</b>		Fax <b>816-410-1748</b>		Attn: <b>Emily Fisher</b>				
Email Address for Result Reporting <b>emily.fisher@tetratech.com</b>				415 Oak Street, Kansas City, MO 64106				
emily.fisher@tetratech.com				emily.fisher@tetratech.com				
Client Sample ID	Laboratory ID Number	Date/Time Start	Date/Time End	Total Sampling Time (minutes)	Sampling Temp 25°C assumed if not specified	Radiello ID Sticker Number		
WAA-01-RH-PS-20150119	①	1/5/15 @ 14:06	1/19/15 @ 14:01	20155	-1.7	262FN	X	
WAA-02-RH-PS-20150119	②	1/5/15 @ 13:09	1/19/15 @ 13:14	20165	-1.7	263FN	X	
WAA-03-RH-PS-20150119	③	1/5/15 @ 13:30	1/19/15 @ 13:40	20170	-1.7	264FN	X	
WAA-04-RH-PS-20150119	④	1/5/15 @ 13:43	1/19/15 @ 13:52	20169	-1.7	265FN	X	
WAA-05-RH-PS-20150119	⑤	1/5/15 @ 13:19	1/19/15 @ 13:20	20161	-1.7	266FN	X	
WAA-04-RH-DU-20150119	⑥	1/5/15 @ 13:43	1/19/15 @ 13:52	20169	-1.7	267FN	X	
WAA-00-RH-TB-20150119	⑦	1/5/15 @ 14:15	1/19/15 @ 13:00	NA	NA	268FN	X	
<b>Report Tier Levels - please select one</b> Tier I - (Results/Default if not specified) _____ Tier III (Data Validation Package) 10% Surcharge _____ EDD required Yes _____ Tier II (Results + QC) _____ Tier V (client specified) _____ Type: _____								
Relinquished by: (Signature) <i>[Signature]</i>				Date: 1-21-15	Time: 11:32	Received by: (Signature) <i>[Signature]</i>		Date: _____ Time: _____
Relinquished by: (Signature) <i>[Signature]</i>				Date: _____	Time: _____	Received by: (Signature) <i>[Signature]</i>		Date: 1/21/15 Time: 0935
Relinquished by: (Signature)				Date: _____	Time: _____	Received by: (Signature)		Date: _____ Time: _____
Cooler / Blank Temperature <b>10</b> °C								

Project Requirements (MRLs, QAPP)

Chain of Custody Seal: (Circle)  
INTACT ☒ BROKEN ☐ ABSENT ☐

**ALS Environmental**  
**Sample Acceptance Check Form**

Client: Tetra Tech, Incorporated

Work order: P1500232

Project: West Lake Landfill / 103X9025140058

Sample(s) received on: 1/21/15

Date opened: 1/21/15

by: ADAVID

**Note:** This form is used for all samples received by ALS. The use of this form for custody seals is strictly meant to indicate presence/absence and not as an indication of compliance or nonconformity. Thermal preservation and pH will only be evaluated either at the request of the client and/or as required by the method/SOP.

	<b>Yes</b>	<b>No</b>	<b>N/A</b>
1 Were <b>sample containers</b> properly marked with client sample ID?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2 Container(s) <b>supplied by ALS</b> ?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3 Did <b>sample containers</b> arrive in good condition?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4 Were <b>chain-of-custody</b> papers used and filled out?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5 Did <b>sample container labels</b> and/or tags agree with custody papers?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6 Was <b>sample volume</b> received adequate for analysis?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7 Are samples within specified holding times?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8 Was proper <b>temperature</b> (thermal preservation) of cooler at receipt adhered to?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Cooler Temperature: 10° C    Blank Temperature: ° C			
9 Was a <b>trip blank</b> received?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10 Were <b>custody seals</b> on outside of cooler/Box?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Location of seal(s)? _____ Sealing Lid?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Were signature and date included?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Were seals intact?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Were custody seals on outside of sample container?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Location of seal(s)? _____ Sealing Lid?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Were signature and date included?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Were seals intact?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
11 Do containers have appropriate <b>preservation</b> , according to method/SOP or Client specified information?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Is there a client indication that the submitted samples are <b>pH</b> preserved?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Were <b>VOA vials</b> checked for presence/absence of air bubbles?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Does the client/method/SOP require that the analyst check the sample pH and <u>if necessary</u> alter it?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
12 <b>Tubes:</b> Are the tubes capped and intact?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Do they contain moisture?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
13 <b>Badges:</b> Are the badges properly capped and intact?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Are dual bed badges separated and individually capped and intact?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

Lab Sample ID	Container Description	Required pH *	Received pH	Adjusted pH	VOA Headspace (Presence/Absence)	Receipt / Preservation Comments
P1500232-001.01	Passive (Radiello H2S)					
P1500232-002.01	Passive (Radiello H2S)					
P1500232-003.01	Passive (Radiello H2S)					
P1500232-004.01	Passive (Radiello H2S)					
P1500232-005.01	Passive (Radiello H2S)					
P1500232-006.01	Passive (Radiello H2S)					
P1500232-007.01	Passive (Radiello H2S)					

Explain any discrepancies: (include lab sample ID numbers): \_\_\_\_\_

# ALS ENVIRONMENTAL

## RESULTS OF ANALYSIS

Page 1 of 1

Client: Tetra Tech, Incorporated  
Client Project ID: West Lake Landfill / 103X9025140058

ALS Project ID: P1500232

## Hydrogen Sulfide

Test Code: ALS AQL 110  
Instrument ID: P-UV-Vis-01  
Analyst: Sue Anderson  
Sampling Media: Radiello Tube(s)  
Test Notes:

Date(s) Collected: 1/19/15  
Date Received: 1/21/15  
Date Extracted: 1/21/15  
Date Analyzed: 1/21/15  
Desorption Volume: 0.010 Liter(s)

Client Sample ID	ALS Sample ID	Sampling		Result ng/Sample	MRL ng/Sample	MDL ng/Sample	Result µg/m³	MRL µg/m³	MDL µg/m³	Data Qualifier
		Time Minutes	Dilution Factor							
WAA-01-R11-PS-20150119	P1500232-001	20155	1.0	280	570	110	0.29	0.59	0.11	J
WAA-02-R11-PS-20150119	P1500232-002	20165	1.0	220	570	110	0.22	0.58	0.11	J
WAA-03-R11-PS-20150119	P1500232-003	20170	1.0	160	570	110	0.16	0.58	0.11	J
WAA-04-R11-PS-20150119	P1500232-004	20169	1.0	290	570	110	0.30	0.58	0.11	J
WAA-05-R11-PS-20150119	P1500232-005	20161	1.0	240	570	110	0.24	0.58	0.11	J
WAA-06-R11-DU-20150119	P1500232-006	20169	1.0	240	570	110	0.24	0.58	0.11	J
WAA-00-R11-TB-20150119	P1500232-007	NA	1.0	ND	570	110	NA	NA	NA	
Method Blank	P150121-MB	NA	1.0	ND	570	110	NA	NA	NA	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

J = The result is an estimated concentration that is less than the MRL but greater than or equal to the MDL.

NA = Not applicable.

HVE  
25 February 2015



# ALS ENVIRONMENTAL

## RESULTS OF ANALYSIS

Page 1 of 1

**Client:** Tetra Tech, Incorporated  
**Client Sample ID:** Duplicate Lab Control Sample  
**Client Project ID:** West Lake Landfill / 103X9025140058

ALS Project ID: P1500232  
ALS Sample ID: P150121-LCS,  
P150121-DLCS

### Laboratory Control Sample/Duplicate Laboratory Control Sample Summary

**Test Code:** ALS AQL 110  
**Instrument ID:** P-UV-Vis-01  
**Analyst:** Sue Anderson  
**Sampling Media:** Radiello Tube(s)  
**Test Notes:**

**Date Sampled:** NA  
**Date Received:** NA  
**Date Analyzed:** 1/21/15  
**Volume(s) Analyzed:** NA

Compound	Spike Amount	Result		% Recovery		ALS Acceptance Limits	Relative Percent Difference	RPD Limit	Data Qualifier
	LCS / DLCS µg/L	LCS µg/L	DLCS µg/L	LCS	DLCS				
Hydrogen Sulfide	500	536	538	107	108	73-129	1	5	



ALS Environmental

# Hydrogen Sulfide (H<sub>2</sub>S) in Air Bench Sheet

ALS AQL 110

Service Request#: F1500074 P150232

Prep Run #: 227759

Run #: 429943 page 1002

	Ref #	Concentration (ug/L)	Exp. Date
RAD 171 Stock	524-0915/401	57250 ug/L	9/2/15
Sulfide ICV/CCV	524-0908/401	500 425 ug/L	4/8/15

Reagents	Reference or Lot #	Exp. Date	Coloring Solution
Ferric Chloride	524-0625/402	6/25/15	10 mL Ferric Cl + 50 mL Amino Sulfuric
Amino Sulfuric	524-1231/402	1/31/15	prepped prior to coloring step
radiello Tube	14315	09/15	

Calibration Curve: RAD 171 diluted to volume with Deionized Water

10 mL aliquot of each Prep run	NA	0.05 / 50	0.10 / 50	0.20 / 50	0.50 / 50	0.75 / 50	1.0 / 50	Corr. Coeff			
ug/L (ppb)	0	57.3	115	229	573	859	1145				
Abs. @ 665 nm	0.000	0.053	0.124	0.230	0.577	0.865	1.140	0.999732648			
Temp. Corrected											
Sample ID	Sampling Time (mins)	Temp	Extract Volume (L)	Dilution	Blank Subtract Abs.	Absorbance @ 665 nm	Corrected Abs.*	Result ug/L (ppb)	Result ug/sample	Result H <sub>2</sub> S ppbV**	Result ug/m <sup>3</sup> ***
ICB	—	—	—	—	—	0.000	0.000	-2.19/460	4116		
ICV 500 ug/L	—	—	—	—	—	0.508	0.508	507			101%
MB1	—	25°C	0.010	—	—	0.011	0.011	8.83 / 4116	4110		
MB2	—	—	—	—	—	0.011	0.011	8.83 / 4116	4110		
LCS 500 ug/L	—	—	—	—	0.011	0.578	0.567	565.687 / 336.196	5362		107%
DLCS	—	—	—	—	0.011	0.580	0.569	567.690 / 338.195	5381		108%
P1500074-1.01	13129	-0.60	—	—	0.011	0.049	0.038	35.872	340.019	0.38	0.53
— 2.01	13070	—	—	—	0.011	0.038	0.027	24.855	235.593	0.26	0.37
— 3.01	13070	—	—	—	0.011	0.050	0.039	36.874	349.512	0.39	0.55
— 4.01	13093	—	—	—	0.011	0.054	0.043	40.380	387.486	0.43	0.60
— 5.01	13066	—	—	—	0.011	0.050	0.039	36.874	349.512	0.39	0.55
— 6.01	13093	—	—	—	0.011	0.055	0.044	41.881	376.779	0.44	0.62
CCV 500 ug/L	—	—	—	—	—	0.506	0.506	505			101%
CCV	—	—	—	—	—	0.000	0.000	-2.19/4116			

\*Concentration after blank subtraction (as applicable)

Comments: \*\*H<sub>2</sub>S in ppbV = ng H<sub>2</sub>S / (0.096 ng/ppb · min) x time in minutes; \*\*\*ug/m<sup>3</sup> = ppbV H<sub>2</sub>S x (34.09 MW of H<sub>2</sub>S / 24.46 gas constant)

LCS (500 ug/L): spike tube with 0.5 ml of freshly prepped 10 ppm sulfide solution [0.0764g Sodium Sulfide up to 1L with DI] up to 10 mL desorb volume

Prepped By: JS

Analyzed By: JS

Reviewed By: MD

Date: 1/21/15 @ 1400

Date: 1/21/15 @ 1430

Date: 1/22/15

TEMP CORRECTION =  $\left(\frac{K}{273}\right)^{3.8}$   
APPLY TO OUR SAMPLING RATE

RL = 570 ng  
MDL = 110 ng



ALS Environmental

Service Request#: \_\_\_\_\_

# Hydrogen Sulfide (H<sub>2</sub>S) in Air Bench Sheet

ALS AQL 110

Prep Run #: 227759

Run #: 429943 page 282

	Ref #	Concentration (ug/L)	Exp. Date
RAD 171 Stock	<u>524-091540</u>	57250 ug/L	<u>9/2/15</u>
Sulfide ICV/CCV	<u>524-04081401</u>	425 ug/L	<u>4/8/15</u>

@ 900x 900 8/12/15

Reagents	Reference or Lot #	Exp. Date	Coloring Solution
Ferric Chloride	<u>524-06251402</u>	<u>6/25/15</u>	10 mL Ferric Cl + 50 mL Amino Sulfuric
Amino Sulfuric	<u>524-12311402</u>	<u>1/31/15</u>	prepped prior to coloring step
radiello Tube	<u>14315</u>	<u>09/15</u>	

Calibration Curve: RAD 171 diluted to volume with Deionized Water

10 mL aliquot of each Prep run	NA	0.05 / 50	0.10 / 50	0.20 / 50	0.50 / 50	0.75 / 50	1.0 / 50	Corr. Coeff			
ug/L (ppb)	0	57.3	115	229	573	859	1145	<u>0.99932648</u>			
Abs. @ 665 nm	<u>0.000</u>	<u>0.053</u>	<u>0.124</u>	<u>0.230</u>	<u>0.577</u>	<u>0.865</u>	<u>1.140</u>	<u>RELLECTED</u>			
								Temp. Corrected			
Sample ID	Sampling Time (mins)	Temp	Extract Volume (L)	Dilution	Blank Subtract Abs.	Absorbance @ 665 nm	Corrected Abs.*	Result ug/L (ppb)	Result ng/sample	Result H <sub>2</sub> S ppbV**	Result ug/m <sup>3</sup> ***
P1500674-7.01	<u>0</u>	<u>NA</u>	<u>0.010</u>	—	<u>0.011</u>	<u>0.012</u>	<u>0.001</u>	<u>-1.18 / 411.6</u>	<u>L110</u>		
P1500232-1.01	<u>20155</u>	<u>-1.7°C</u>	—	—	<u>0.011</u>	<u>0.043</u>	<u>0.032</u>	<u>29.863</u>	<u>283.059</u>	<u>0.21</u>	<u>0.29</u>
-2.01	<u>20165</u>	—	—	—	<u>0.011</u>	<u>0.036</u>	<u>0.025</u>	<u>22.850</u>	<u>216.606</u>	<u>0.16</u>	<u>0.22</u>
-3.01	<u>20170</u>	—	—	—	<u>0.011</u>	<u>0.030</u>	<u>0.019</u>	<u>16.843</u>	<u>159.647</u>	<u>0.12</u>	<u>0.16</u>
-4.01	<u>20169</u>	—	—	—	<u>0.011</u>	<u>0.044</u>	<u>0.033</u>	<u>30.864</u>	<u>292.553</u>	<u>0.22</u>	<u>0.30</u>
-5.01	<u>20161</u>	—	—	—	<u>0.011</u>	<u>0.038</u>	<u>0.027</u>	<u>24.855</u>	<u>235.593</u>	<u>0.17</u>	<u>0.24</u>
-6.01	<u>20169</u>	<u>✓</u>	—	—	<u>0.011</u>	<u>0.038</u>	<u>0.027</u>	<u>24.855</u>	<u>235.59</u>	<u>30.17</u>	<u>0.24</u>
-7.01	<u>0</u>	<u>NA</u>	—	—	<u>0.011</u>	<u>0.015</u>	<u>0.004</u>	<u>1.82 / 411.6</u>	<u>L110</u>		
CCV2 900 ug/L	—	—	—	—	—	<u>0.504</u>	<u>0.504</u>	<u>503</u>			<u>1010</u>
CCV2	—	—	—	—	—	<u>0.000</u>	<u>0.000</u>	<u>-2.19 / 411.6</u>			

ICV/CCV Acceptance Criteria: 90 - 110%

LCS/DLCS Acceptance Criteria: 73 - 129%

RPD Acceptance Criteria: ≤ 5%

Note: the results as calculated on the Bench Sheet may vary slightly than what is reported due to sig figs used for calculation.

\*Concentration after blank subtraction (as applicable)

Comments: \*\*H<sub>2</sub>S in ppbV = ng H<sub>2</sub>S / (0.096 ng/ppb · min) x time in minutes; \*\*\*ug/m<sup>3</sup> = ppbV H<sub>2</sub>S x (34.09 MW of H<sub>2</sub>S / 24.46 gas constant)

LCS (500 ug/L): spike tube with 0.5 ml of freshly prepped 10 ppm sulfide solution [0.0764g Sodium Sulfide up to 1L with DI] up to 10 mL desorb volume

Prepped By: \_\_\_\_\_

Analyzed By: \_\_\_\_\_

Reviewed By: \_\_\_\_\_

Date: 1/21/15 @ 1400

Date: 1/21/15 @ 1430

Date: 1/22/15

TEMP CORRECTION =  $\left(\frac{K}{298}\right)^3$   
APPLY TO RPD SAMPLING RATE

3/18/14  
JL524-03181401 500PPM NO<sub>2</sub>

Purchased

Ricca Chemical Company Cat No 5444.5-4

Lot # 2403762

120ml Amber glass

EXP: 9/20/14

3/20/14  
JL524-03201401 0.1 N H<sub>2</sub>SO<sub>4</sub>5.6 ml conc H<sub>2</sub>SO<sub>4</sub> (EMD 49284; EXP: 11/20/14) ↑ 2L W/DI

EXP: 11/20/14

4/8/14  
JL

524-04081401

Methylene Blue 1% Sol

100ml purchased

Alfa Aesar  
stock # 42771

lot K207010

4/8/14

22600005/L  
250000

EXP: 4/8/15

4/8/14  
JL524-04081402 0.1 N H<sub>2</sub>SO<sub>4</sub>5.6 ml conc H<sub>2</sub>SO<sub>4</sub> (EMD 49284; EXP: 11/20/14) ↑ 2L W/DI H<sub>2</sub>O

EXP: 11/20/14

4/22/14  
JL524-04221401 1000PPM SO<sub>3</sub> Stock0.1591g Na<sub>2</sub>SO<sub>3</sub> (JT later lot # H10627; EXP: 8/31/14)  
↑ 100ml W/DI H<sub>2</sub>O.

EXP: 5/6/14

Sol  
1.  
DI H<sub>2</sub>O  
6/25/14 S24-06251401 1:1 H<sub>2</sub>SO<sub>4</sub>  
250ml conc H<sub>2</sub>SO<sub>4</sub> (EMD 49284; EXP: 11/20/14) +  
250ml DI H<sub>2</sub>O  
EXP: 11/20/14

etc  
8/31/14  
6/25/14 S24-06251402 Ferric Chloride Soln  
100g FeCl<sub>3</sub>·6H<sub>2</sub>O (Mallinckrodt J13631;  
EXPI 9/25/15)  
EXP: 6/25/15

Inv/con  
EXP 8/1/14  
6/25/14 S24-06251403 Sulfanilamide Soln  
5.00g Sulfanilamide (JT Baker lot J32618; EXP 11/6/16)  
DISSOLVED IN 50ml CONC HCl (EMP lot # 49280;  
EXP: 2/7/16) ↑ 500ml w/ DI H<sub>2</sub>O  
EXP: 6/25/15

25ml/pkts  
6/25/14 S24-06251404 AMINE Soln  
SLOWLY ADD 6.25ml CONC H<sub>2</sub>SO<sub>4</sub> (EMD 49284;  
EXP: 11/20/14 TO 2.5ml DI let cool.  
DISSOLVE 1.6875g N,N-dimethyl-1,4-phenylene  
diamine oxalat (ALDRICH MCB78241V; EXP:  
5/24/16) IN ABOVE ACID Soln then dilute  
to 250 ml w/ 1:1 H<sub>2</sub>SO<sub>4</sub> (S24-06251401;  
EXP: 11/20/14).  
EXP: 0725/14

Sol  
Conc  
w/

9/8/14 SZ4-09081401 0.1 N H<sub>2</sub>SO<sub>4</sub>  
5.6 ml CONC H<sub>2</sub>SO<sub>4</sub> (EMD 49284; EXP: 11/20/14)  
↑ 2L W/DI H<sub>2</sub>O  
EXP: 11/20/14

9/8/14 SZ4-09081402 1.0 N NaOH  
8.0 g NaOH (EMD 150630529 12/13) ↑ 100 ml  
W/DI H<sub>2</sub>O  
EXP: 9/8/15

9/15/14 SZ4-09151401 H<sub>2</sub>S radiello stock  
Purchased Sigma Aldrich  
RAD 171 100 ml Amber GLASS  
LOT# 14279102 CAT# RAD 171  
Prepped 1:50 ⇒ 1.145 µg/ml Sulfide  
EXP: 9/2/15

#### Calibration solution for Hydrogen Sulphide (code RAD171)

CAUTION: Do not swallow. Wash the hands thoroughly after use. Avoid contact with the eyes, skin and clothes. In case of contact with eyes, flush with large amounts of running water for at least 15 minutes. See MSDS for complete safety information.

##### Description

Code RAD171 relieves you from the task of preparing the sodium sulfide standard solution for the calibration curve used for the determination of H<sub>2</sub>S by the cartridge code RAD170.

Since sodium sulfide is deliquescent, its weight is not a primary standard and sodium sulfide solution need titration once prepared. Moreover titration must be repeated often due to the instability of diluted solution (one hour time is sufficient to decrease sulfide content by 10%).

Code RAD171 is a methylene blue concentrated solution that, once diluted 1:50, provides the same absorbance value at 665 nm of a sodium sulfide solution of with concentration 1.145 µg·ml<sup>-1</sup> sulfide ions.

This concentration value has been chosen to obtain the highest absorbance value within the linearity range of the spectrophotometer. To obtain a complete calibration curve, just dilute the mother solution as shown in the table.

Solution	ml of	ml of water	equivalent to µg·ml <sup>-1</sup> of S <sup>2-</sup>
A	2 of code RAD171	98	1.145
B	25 of A	25	0.572
C	10 of A	40	0.229
D	5 of A	45	0.115

Code RAD171 allows you to prepare as many as 50 calibration curves.

##### Storage

Store in original containers or other appropriately labeled, suitable containers.

Kept in a cool, dry environment away from sources of heat code RAD171 solution is stable for at least one year.



12/31/14  
JR

524-12311401 1:1 H<sub>2</sub>SO<sub>4</sub>  
250ml DI + 250ml Conc H<sub>2</sub>SO<sub>4</sub>  
(EMD 54174; EXP: 11/7/19). LET COOL  
EXP: 12/31/15

12/31/14 524-12311402 Amine Soln  
JR SLOWLY ADD 6.25ml CONC H<sub>2</sub>SO<sub>4</sub> (EMD  
54174; EXP: 11/7/19) TO 2.5ml DI. LET COOL

DISSOLVE 1.6875g N,N-Dimethyl-1,4-phenylenediamine  
oxalate (Aldrich MKBG8241V; EXP: 5/24/16,  
IN ABOVE ADD SOLN. THEN DILUTE TO  
250ml w/ 1:1 H<sub>2</sub>SO<sub>4</sub> (524-12311401; EXP:  
12/31/15  
or 12/31/17

**Tetra Tech, Inc.**  
**DATA VALIDATION REPORT**  
**LEVEL II**

Site: West Lake Landfill Site, Bridgeton, Missouri

Laboratory: ALS Environmental (Simi Valley, California)

Data Reviewer: Harry Ellis, Tetra Tech, Inc. (Tetra Tech)

Review Date: February 25, 2015

Sample Delivery Group (SDG): P15000342

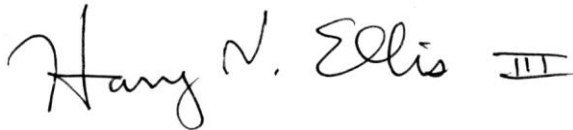
Sample Numbers: WAA-01-RH-PS-20150128, WAA-02-RH-PS-20150128, WAA-03-RH-PS-20150128, WAA-04-RH-PS-20150128, WAA-04-RH-DU-20150128, WAA-05-RH-PS-20150128, and WAA-00-RH-TB-20150128

Matrix / Number of Samples: 5 Air Samples, 1 Field Duplicate Sample, and 1 Trip Blank

The data were qualified according to the U.S. Environmental Protection Agency (EPA) Region 7 documents entitled "Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review" (9240.1-48), June 2008. In addition, the Tetra Tech document "Review of Data Packages from Subcontracted Laboratories" (February 2002) was used along with other criteria specified in the applicable methods.

The review was intended to identify problems and quality control (QC) deficiencies that were readily apparent from the summary data package. The following sections discuss any problems or deficiencies that were found, and data qualifications applied because of non-compliant QC. The data review was limited to the available field and laboratory QC information submitted with the project-specific data package.

I, Harry Ellis, certify that all data validation criteria outlined in the above-referenced documents were assessed, and any qualifications made to the data accorded with those documents.



25 February 2015

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Certified by Harry Ellis, Chemist

---

Date



## DATA VALIDATION QUALIFIERS

- U** — The analyte was not detected above the reported sample quantitation limit.
- J** — The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.
- UJ** — The analyte was not detected above the reported sample quantitation limit, which is estimated.
- R** — The sample results are rejected due to serious deficiencies in the ability to analyze the sample and meet QC criteria. Presence or absence of the analyte cannot be verified.

## **DATA ASSESSMENT**

Sample delivery group (SDG) P1500342 included five (5) environmental air (Radiello™ adsorbent tube) samples and two (2) QC samples (a field duplicate and a trip blank). Samples were analyzed for hydrogen sulfide via the laboratory's implementation of the manufacturer's method. The following summarizes the data validation that was performed.

### **VOLATILE ORGANIC COMPOUND ANALYSIS**

#### **I. Holding Time and Chain of Custody (COC) Requirements**

The samples were received by the laboratory and analyzed within the accepted holding time of 30 days from sample collection by tube to analysis. No data were qualified.

#### **II. Matrix Spike/Matrix Spike Duplicate (MS/MSD)**

MS/MSD analyses are not practical for air analyses. Satisfactory LCS and field duplicate sample analysis provided adequate data on precision and accuracy. No qualifications were applied.

#### **III. Blanks**

No analytes were detected in the laboratory (method) and field blanks. No qualifications were applied.

#### **IV. Laboratory Control Sample (LCS)**

All results for the duplicate LCS were within QC limits.

#### **V. Surrogates**

Surrogates are not used in this analysis.

#### **VI. Comments**

All detected results in the field samples were less than the sample reporting limits, which correspond to the lowest calibration standard. The laboratory correctly qualified these results as estimated and flagged them "J". All detected results, including the field duplicate pair, were quite similar.

#### **VII. Overall Assessment of Data**

Overall data quality is acceptable, with no qualifications added. All data are usable as reported for their intended purposes.

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2655 Park Center Dr., Suite A  
Simi Valley, CA 93065  
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[www.alsglobal.com](http://www.alsglobal.com)

## LABORATORY REPORT

February 17, 2015

Rob Monnig  
Tetra Tech, Incorporated  
415 Oak Street  
Kansas City, MO 64106

**RE: West Lake Landfill / 103X9025140058**

Dear Rob:

Enclosed are the results of the samples submitted to our laboratory on January 29, 2015. For your reference, these analyses have been assigned our service request number P1500342.

All analyses were performed according to our laboratory's NELAP and DoD-ELAP-approved quality assurance program. The test results meet requirements of the current NELAP and DoD-ELAP standards, where applicable, and except as noted in the laboratory case narrative provided. For a specific list of NELAP and DoD-ELAP-accredited analytes, refer to the certifications section at [www.alsglobal.com](http://www.alsglobal.com). Results are intended to be considered in their entirety and apply only to the samples analyzed and reported herein.

If you have any questions, please call me at (805) 526-7161.

Respectfully submitted,

**ALS | Environmental**



By Sue Anderson at 9:58 am, Feb 17, 2015

Sue Anderson  
Project Manager



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[www.alsglobal.com](http://www.alsglobal.com)

Client: Tetra Tech, Incorporated  
Project: West Lake Landfill / 103X9025140058

Service Request No: P1500342

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### CASE NARRATIVE

The samples were received intact under chain of custody on January 29, 2015 and were stored in accordance with the analytical method requirements. Please refer to the sample acceptance check form for additional information. The results reported herein are applicable only to the condition of the samples at the time of sample receipt.

#### Hydrogen Sulfide in Air (H<sub>2</sub>S) Analysis

The samples were prepared in accordance with CAS AQL 110 for hydrogen sulfide in air and analyzed by colorimetric method using a spectrophotometer. This method is not included on the laboratory's NELAP, DoD-ELAP, or AIHA-LAP scope of accreditation.

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*The results of analyses are given in the attached laboratory report. All results are intended to be considered in their entirety, and ALS Environmental (ALS) is not responsible for utilization of less than the complete report.*

*Use of ALS Environmental (ALS)'s Name. Client shall not use ALS's name or trademark in any marketing or reporting materials, press releases or in any other manner ("Materials") whatsoever and shall not attribute to ALS any test result, tolerance or specification derived from ALS's data ("Attribution") without ALS's prior written consent, which may be withheld by ALS for any reason in its sole discretion. To request ALS's consent, Client shall provide copies of the proposed Materials or Attribution and describe in writing Client's proposed use of such Materials or Attribution. If ALS has not provided written approval of the Materials or Attribution within ten (10) days of receipt from Client, Client's request to use ALS's name or trademark in any Materials or Attribution shall be deemed denied. ALS may, in its discretion, reasonably charge Client for its time in reviewing Materials or Attribution requests. Client acknowledges and agrees that the unauthorized use of ALS's name or trademark may cause ALS to incur irreparable harm for which the recovery of money damages will be inadequate. Accordingly, Client acknowledges and agrees that a violation shall justify preliminary injunctive relief. For questions contact the laboratory.*



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ALS Environmental – Simi Valley

CERTIFICATIONS, ACCREDITATIONS, AND REGISTRATIONS

Agency	Web Site	Number
AIHA	<a href="http://www.aihaaccreditedlabs.org">http://www.aihaaccreditedlabs.org</a>	101661
Arizona DHS	<a href="http://www.azdhs.gov/lab/license/env.htm">http://www.azdhs.gov/lab/license/env.htm</a>	AZ0694
DoD ELAP	<a href="http://www.pjlabs.com/search-accredited-labs">http://www.pjlabs.com/search-accredited-labs</a>	L14-2
Florida DOH (NELAP)	<a href="http://www.doh.state.fl.us/lab/EnvLabCert/WaterCert.htm">http://www.doh.state.fl.us/lab/EnvLabCert/WaterCert.htm</a>	E871020
Maine DHHS	<a href="http://www.maine.gov/dhhs/mecdc/environmental-health/water/dwp-services/labcert/labcert.htm">http://www.maine.gov/dhhs/mecdc/environmental-health/water/dwp-services/labcert/labcert.htm</a>	2014025
Minnesota DOH (NELAP)	<a href="http://www.health.state.mn.us/accreditation">http://www.health.state.mn.us/accreditation</a>	838341
New Jersey DEP (NELAP)	<a href="http://www.nj.gov/dep/oqa/">http://www.nj.gov/dep/oqa/</a>	CA009
New York DOH (NELAP)	<a href="http://www.wadsworth.org/labcert/elap/elap.html">http://www.wadsworth.org/labcert/elap/elap.html</a>	11221
Oregon PHD (NELAP)	<a href="http://public.health.oregon.gov/LaboratoryServices/EnvironmentalLaboratoryAccreditation/Pages/index.aspx">http://public.health.oregon.gov/LaboratoryServices/EnvironmentalLaboratoryAccreditation/Pages/index.aspx</a>	CA200007
Pennsylvania DEP	<a href="http://www.depweb.state.pa.us/labs">http://www.depweb.state.pa.us/labs</a>	68-03307 (Registration)
Texas CEQ (NELAP)	<a href="http://www.tceq.texas.gov/field/qa/env_lab_accreditation.html">http://www.tceq.texas.gov/field/qa/env_lab_accreditation.html</a>	T104704413-14-5
Utah DOH (NELAP)	<a href="http://www.health.utah.gov/lab/labimp/certification/index.html">http://www.health.utah.gov/lab/labimp/certification/index.html</a>	CA01627201 4-4
Washington DOE	<a href="http://www.ecy.wa.gov/programs/eap/labs/lab-accreditation.html">http://www.ecy.wa.gov/programs/eap/labs/lab-accreditation.html</a>	C946

Analyses were performed according to our laboratory's NELAP and DoD-ELAP approved quality assurance program. A complete listing of specific NELAP and DoD-ELAP certified analytes can be found in the certifications section at [www.alsglobal.com](http://www.alsglobal.com), or at the accreditation body's website.

Each of the certifications listed above have an explicit Scope of Accreditation that applies to specific matrices/methods/analytes; therefore, please contact the laboratory for information corresponding to a particular certification.

## ALS ENVIRONMENTAL

### DETAIL SUMMARY REPORT

Client: Tetra Tech, Incorporated  
Project ID: West Lake Landfill / 103X9025140058

Service Request: P1500342

Date Received: 1/29/2015  
Time Received: 09:40

CAS AQL 110 - H2S Air

Client Sample ID	Lab Code	Matrix	Date Collected	Time Collected	
WAA-01-RH-PS-20150128	P1500342-001	Air	1/28/2015	14:02	X
WAA-02-RH-PS-20150128	P1500342-002	Air	1/28/2015	13:21	X
WAA-03-RH-PS-20150128	P1500342-003	Air	1/28/2015	13:39	X
WAA-04-RH-PS-20150128	P1500342-004	Air	1/28/2015	13:53	X
WAA-05-RH-PS-20150128	P1500342-005	Air	1/28/2015	13:29	X
WAA-04-RH-DU-20150128	P1500342-006	Air	1/28/2015	13:53	X
WAA-00-RH-TB-20150128	P1500342-007	Air	1/28/2015	14:09	X

# Radiello - Chain of Custody Record & Analytical Service Request

Page 1 of 1



2655 Park Center Drive, Suite A  
Simi Valley, California 93065  
Phone (805) 526-7161  
Fax (805) 526-7270

Requested Turnaround Time in Business Days (Surcharges) please circle 1 Day (100%) 2 Day (75%) 3 Day (50%) 4 Day (35%) 5 Day (25%) 10 Day-Standard	ALS Project No. <b>P1508342</b>
---	---------------------------------

Company Name & Address (Reporting Information) <b>Tetra Tech 415 Oak Street, Kansas City, MO 64106</b>				Project Name <b>West Lake Landfill</b>			ALS Contact: <b>Sue Anderson</b>		Analysis: (e.g. NO <sub>2</sub> , SO <sub>2</sub> , O <sub>3</sub> , VOCs, Aldehyde, Ammonia)	Comments
Project Manager <b>Rob Monnig (816-412-1775) / Dave Kinroth (314-517-6798)</b>				Project Number <b>103X9025140068</b>			P.O. # / Credit Card / Billing Information <b>PO 1111500</b>			
Phone <b>816-412-1775</b>		Fax <b>816-410-1748</b>		Attn: <b>Emily Fisher</b>			Hydrogen Sulfide			
Email Address for Result Reporting <b>emily.fisher@tetrattech.com</b>				emily.fisher@tetrattech.com						
Client Sample ID	Laboratory ID Number	Date/Time Start	Date/Time End	Total Sampling Time (minutes)	Sampling Temp 25°C assumed if not specified	Radiello ID Sticker Number				
WAA-01-RH-PS-20150128	<b>1</b>	1/19/15 @ 14:01	1/28/15 @ 14:02	12961	3.3	785HT	X			
WAA-02-RH-PS-20150128	<b>2</b>	1/19/15 @ 13:14	1/28/15 @ 13:21	12967	3.3	786HT	X			
WAA-03-RH-PS-20150128	<b>3</b>	1/19/15 @ 13:40	1/28/15 @ 13:39	12959	3.3	787HT	X			
WAA-04-RH-PS-20150128	<b>4</b>	1/19/15 @ 13:52	1/28/15 @ 13:53	12961	3.3	788HT	X			
WAA-05-RH-PS-20150128	<b>5</b>	1/19/15 @ 13:20	1/28/15 @ 13:29	12969	3.3	789HT	X			
WAA-04-RH-DU-20150128	<b>6</b>	1/19/15 @ 13:52	1/28/15 @ 13:53	12961	3.3	790HT	X			
WAA-00-RH-TB-20150128	<b>7</b>	1/19/15 @ 13:00	1/28/15 @ 14:09	NA	NA	791HT	X			

## Report Tier Levels - please select one

Tier I - (Results/Default if not specified) _____		Tier III (Data Validation Package) 10% Surcharge _____		EDD required Yes _____		Chain of Custody Seal (Circle) INTACT BROKEN ABSENT		Project Requirements (MRLs, QAPP)	
Tier II (Results + QC) _____		Tier V (client specified) _____		Type: _____					
Relinquished by: (Signature) <i>[Signature]</i>		Date: <b>1-28-15</b>	Time: <b>1514</b>	Received by: (Signature) <i>[Signature]</i>		Date: <b>1/29/15</b>	Time: <b>0940</b>	<b>1<sup>st</sup> WET ICE</b>	
Relinquished by: (Signature) <i>[Signature]</i>		Date:	Time:	Received by: (Signature) <i>[Signature]</i>		Date:	Time:		
Relinquished by: (Signature)		Date:	Time:	Received by: (Signature)		Date:	Time:		
Cooler / Blank Temperature _____ °C									



**ALS Environmental**  
**Sample Acceptance Check Form**

Client: Tetra Tech, Incorporated

Work order: P1500342

Project: West Lake Landfill / 103X9025140058

Sample(s) received on: 1/29/2015

Date opened: 1/29/2015

by: KKELPE

**Note:** This form is used for all samples received by ALS. The use of this form for custody seals is strictly meant to indicate presence/absence and not as an indication of compliance or nonconformity. Thermal preservation and pH will only be evaluated either at the request of the client and/or as required by the method/SOP.

	<b>Yes</b>	<b>No</b>	<b>N/A</b>
1 Were <b>sample containers</b> properly marked with client sample ID?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2 Container(s) <b>supplied by ALS</b> ?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3 Did <b>sample containers</b> arrive in good condition?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4 Were <b>chain-of-custody</b> papers used and filled out?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5 Did <b>sample container labels</b> and/or tags agree with custody papers?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6 Was <b>sample volume</b> received adequate for analysis?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7 Are samples within specified holding times?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8 Was proper <b>temperature</b> (thermal preservation) of cooler at receipt adhered to?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Cooler Temperature: 1° C    Blank Temperature: ° C			
9 Was a <b>blank tube</b> received?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10 Were <b>custody seals</b> on outside of cooler/Box?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Location of seal(s)? _____ Sealing Lid?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Were signature and date included?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Were seals intact?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Were custody seals on outside of sample container?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Location of seal(s)? _____ Sealing Lid?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Were signature and date included?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Were seals intact?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
11 Do containers have appropriate <b>preservation</b> , according to method/SOP or Client specified information?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Is there a client indication that the submitted samples are <b>pH</b> preserved?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Were <b>VOA vials</b> checked for presence/absence of air bubbles?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Does the client/method/SOP require that the analyst check the sample pH and <u>if necessary</u> alter it?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
12 <b>Tubes:</b> Are the tubes capped and intact?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Do they contain moisture?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
13 <b>Badges:</b> Are the badges properly capped and intact?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Are dual bed badges separated and individually capped and intact?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

Lab Sample ID	Container Description	Required pH *	Received pH	Adjusted pH	VOA Headspace (Presence/Absence)	Receipt / Preservation Comments
P1500342-001.01	Passive (Radiello H2S)					
P1500342-002.01	Passive (Radiello H2S)					
P1500342-003.01	Passive (Radiello H2S)					
P1500342-004.01	Passive (Radiello H2S)					
P1500342-005.01	Passive (Radiello H2S)					
P1500342-006.01	Passive (Radiello H2S)					
P1500342-007.01	Passive (Radiello H2S)					

Explain any discrepancies: (include lab sample ID numbers): \_\_\_\_\_

# ALS ENVIRONMENTAL

## RESULTS OF ANALYSIS

Page 1 of 1

Client: **Tetra Tech, Incorporated**  
 Client Project ID: **West Lake Landfill / 103X9025140058**

ALS Project ID: P1500342

## Hydrogen Sulfide

Test Code: ALS AQL 110  
 Instrument ID: P-UV-Vis-01  
 Analyst: Sue Anderson  
 Sampling Media: Radiello Tube(s)  
 Test Notes:

Date(s) Collected: 1/28/15  
 Date Received: 1/29/15  
 Date Extracted: 2/11/15  
 Date Analyzed: 2/11/15  
 Desorption Volume: 0.010 Liter(s)

Client Sample ID	ALS Sample ID	Sampling		Result ng/Sample	MRL ng/Sample	MDL ng/Sample	Result µg/m³	MRL µg/m³	MDL µg/m³	Data Qualifier
		Time Minutes	Dilution Factor							
WAA-01-RH-PS-20150128	P1500342-001	12961	1.0	300	570	110	0.45	0.85	0.16	J
WAA-02-RH-PS-20150128	P1500342-002	12967	1.0	260	570	110	0.39	0.85	0.16	J
WAA-03-RH-PS-20150128	P1500342-003	12959	1.0	260	570	110	0.38	0.85	0.16	J
WAA-04-RH-PS-20150128	P1500342-004	12961	1.0	400	570	110	0.59	0.85	0.16	J
WAA-05-RH-PS-20150128	P1500342-005	12969	1.0	170	570	110	0.25	0.85	0.16	J
WAA-04-RH-DU-20150128	P1500342-006	12961	1.0	270	570	110	0.41	0.85	0.16	J
WAA-00-RH-TB-20150128	P1500342-007	NA	1.0	ND	570	110	NA	NA	NA	
Method Blank	P150211-MB	NA	1.0	ND	570	110	NA	NA	NA	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

NA = Not applicable.

J = The result is an estimated concentration that is less than the MRL but greater than or equal to the MDL.

HUE  
 25 February 2015

# ALS ENVIRONMENTAL

## RESULTS OF ANALYSIS

Page 1 of 1

**Client:** Tetra Tech, Incorporated  
**Client Sample ID:** Duplicate Lab Control Sample  
**Client Project ID:** West Lake Landfill / 103X9025140058

ALS Project ID: P1500342  
ALS Sample ID: P150211-LCS,  
P150211-DLCS

### Laboratory Control Sample/Duplicate Laboratory Control Sample Summary

**Test Code:** ALS AQL 110  
**Instrument ID:** P-UV-Vis-01  
**Analyst:** Sue Anderson  
**Sampling Media:** Radiello Tube(s)  
**Test Notes:**

**Date Sampled:** NA  
**Date Received:** NA  
**Date Analyzed:** 2/11/15  
**Volume(s) Analyzed:** NA

Compound	Spike Amount	Result		% Recovery		ALS Acceptance Limits	Relative Percent Difference	RPD Limit	Data Qualifier
	LCS / DLCS µg/L	LCS µg/L	DLCS µg/L	LCS	DLCS				
Hydrogen Sulfide	500	549	545	110	109	73-129	1	5	



ALS Environmental

# Hydrogen Sulfide (H<sub>2</sub>S) in Air Bench Sheet

ACS AQL 110

Service Request#: P1500342 P1500481

Prep Run #: 229115

Run #: 432468 page 1 of 2

	Ref #	Concentration (ug/L)	Exp. Date
RAD 171 Stock	524-09151401	57250 ug/L	9/2/15
Sulfide ICV/CCV	524-04081401	500 ug/L	4/8/15

Reagents	Reference or Lot #	Exp. Date	Coloring Solution
Ferric Chloride	524-0627402	6/25/15	10 mL Ferric Cl + 50 mL Amino Sulfuric
Amino Sulfuric	524-07101502	2/10/16	prepped prior to coloring step
radiello Tube	14315	01/15	

Calibration Curve: RAD 171 diluted to volume with Deionized Water

10 mL aliquot of each Prep run	NA	0.05 / 50	0.10 / 50	0.20 / 50	0.50 / 50	0.75 / 50	1.0 / 50	Corr. Coeff			
ug/L (ppb)	0	57.3	115	229	573	859	1145	0.99957443			
Abs. @ 665 nm	0.000	0.054	0.122	0.234	0.574	0.866	1.144	DE CORRECTED			
								Temp Corrected			
Sample ID	Sampling Time (mins)	Temp	Extract Volume (L)	Dilution	Blank Subtract Abs.	Absorbance @ 665 nm	Corrected Abs.*	Result ug/L (ppb)	Result ng/sample	Result H <sub>2</sub> S ppbV**	Result ug/m <sup>3</sup> ***
ICB	—	—	—	—	—	0.000	0.000	-2.05/11.6	11.6		
ICV 500ug/L	—	—	—	—	—	0.534	0.534	532			106
MB1	—	25°C	0.010	—	—	0.013	0.013	10.9/11.6	11.6		
MB2	—	—	—	—	—	0.013	0.013	10.9/11.6	11.6		
LCS 500ug/L	—	—	—	—	0.013	0.0470.574	0.581	570.69	518.52	5440	110
DLS I	—	—	—	—	—	0.0430.570	0.577	544.69	544.73	5447	109%
P1500342-1.0/	12961	3.3°C	—	—	—	0.0480.047	0.034	31.931	302.667	0.32	0.45
—2.0/	12967	—	—	—	—	0.0570.043	0.020	27.933	264.769	0.28	0.40
—3.0/	12959	—	—	—	—	0.0330.042	0.029	26.934	255.295	0.27	0.38
—4.0/	12961	—	—	—	—	0.057	0.044	41.922	397.412	0.43	0.59
—5.0/	12964	—	—	—	—	0.033	0.020	17.938	170.024	0.18	0.25
—6.0/	12961	—	—	—	—	0.044	0.031	28.933	274.244	0.29	0.41
CCV 500ug/L	—	—	—	—	—	0.532	0.532	530			106
CCB1	—	—	—	—	—	0.000	0.000	-2.05/11.6			

\*Concentration after blank subtraction (as applicable)

Comments:\*\*H<sub>2</sub>S in ppbV = ng H<sub>2</sub>S / (0.096 ng/ppb · min) x time in minutes; \*\*\*ug/m<sup>3</sup> = ppbV H<sub>2</sub>S x (34.09 MW of H<sub>2</sub>S / 24.46 gas constant)

LCS (500 ug/L): spike tube with 0.5 ml of freshly prepped 10 ppm sulfide solution [0.0764g Sodium Sulfide up to 1L with DI] up to 10 mL desorb volume

Prepped By: SA

Analyzed By: SA

Reviewed By: SA

Date: 2/11/15 C 1240  
Date: 2/11/15 C 1310  
Date: 2/11/15

TEMP CORRECTION =  $\left(\frac{K}{298}\right)^{38}$   
APPLY TO ALL SAMPLING RATE



ALS Environmental

# Hydrogen Sulfide (H<sub>2</sub>S) in Air Bench Sheet

ACS AQL 110

Service Request#: P1500342 P1500481

Prep Run #: 229115

Run #: 432468

Page 2 of 2

	Ref #	Concentration (ug/L)	Exp. Date
RAD 171 Stock	524-0915401	57250 ug/L	9/2/15
Sulfide ICV/CCV	524-04081401	500 425 ug/L	4/8/15

Reagents	Reference or Lot #	Exp. Date	Coloring Solution
Ferric Chloride	524-06051402	6/25/15	10 mL Ferric Cl + 50 mL Amino Sulfuric
Amino Sulfuric	524-02101502	2/10/16	prepped prior to coloring step
radiello Tube	14315	09/15	

Calibration Curve: RAD 171 diluted to volume with Deionized Water

10 mL aliquot of each Prep run	NA	0.05 / 50	0.10 / 50	0.20 / 50	0.50 / 50	0.75 / 50	1.0 / 50	Corr. Coeff			
ug/L (ppb)	0	57.3	115	229	573	859	1145				
Abs. @ 665 nm	0.000	0.054	0.122	0.234	0.574	0.866	1.144	0.999957443			
									Temp. Corrected		
Sample ID	Sampling Time (mins)	Temp	Extract Volume (L)	Dilution	Blank Subtract Abs.	Absorbance @ 665 nm	Corrected Abs.*	Result ug/L (ppb)	Result ng/sample	Result H <sub>2</sub> S ppbV**	Result ug/m <sup>3</sup> ***
P150342-7.01	0	NA	0.010	—	0.013	0.014	0.001	-1.05/41.6	110		
P150048-1.01	10085	21.2°C	—	—	—	0.032	0.019	16.938	160.550	0.22	0.31
-2.01	10088	—	—	—	—	0.028	0.015	12.940	122.652	0.17	0.24
-3.01	10091	—	—	—	—	0.026	0.013	10.9/41.6	110	10.16	10.22
-4.01	10084	—	—	—	—	0.030	0.017	14.939	141.601	0.20	0.28
-5.01	10088	—	—	—	—	0.029	0.016	13.939	132.127	0.18	0.26
-6.01	10084	—	—	—	—	0.030	0.017	14.939	141.601	0.20	0.28
-7.01	0	NA	—	—	—	0.013	0.000	-2.05/41.6	110		
CCV 2 500 ug/L	—	—	—	—	—	0.532	0.532	530			106%
CU50	—	—	—	—	—	0.000	0.000	-2.05/41.6			

ICV/CCV Acceptance Criteria: 90-110%

LCS/DLCS Acceptance Criteria: 73-129%

RPD Acceptance Criteria: ≤ 5%

Note: the results as calculated on the Bench Sheet may vary slightly than what is reported due to sig figs used for calculation.

\*Concentration after blank subtraction (as applicable)

Comments: \*\*H<sub>2</sub>S in ppbV = ng H<sub>2</sub>S / (0.096 ng/ppb · min) x time in minutes; \*\*\*ug/m<sup>3</sup> = ppbV H<sub>2</sub>S x (34.09 MW of H<sub>2</sub>S / 24.46 gas constant)

LCS (500 ug/L): spike tube with 0.5 ml of freshly prepped 10 ppm sulfide solution [0.0764g Sodium Sulfide up to 1L with DI] up to 10 mL desorb volume

Prepped By: [Signature]

Analyzed By: [Signature]

Reviewed By: [Signature]

Date: 2/11/15

Date: 2/11/15

Date: 2/12/15

TEMP CORRECTION =  $\left(\frac{K}{298}\right)$

APPLY TO RPD SAMPLING RATE

3/18/14 524-03181401 500PM NO2  
 Purchased  
 Ricca Chemical Company Cat No 5444.5-4  
 Lot # 2403762 120ml Amber glass  
 Exp: 9/20/14

3/20/14 524-03201401 0.1 N H2SO4  
 5.6 ml conc H2SO4 (EMD 49284; Exp:  
 11/20/14) ↑ 2L w/ DI  
 Exp: 11/20/14

4/8/14 524-04081401 Methylene Blue 2% Sol  
 100ml, purchased 4/8/14 2425000 13 L  
 Alfa Aesar Lot K206010 2500000  
 Exp: 4/8/15

4/8/14 524-04081402 0.1 N H2SO4  
 5.6 ml conc H2SO4 (EMD 49284; Exp:  
 11/20/14) ↑ 2L w/ DI H2O  
 Exp: 11/20/14

4/22/14 524-04221401 1000ppm SO3 Stock  
 0.1591g Na2SO3 (JT Baker Lot # H10627; Exp: 8/31)  
 ↑ 100ml w/ DI H2O.  
 Exp: 5/6/14



6/25/14 S24-06251401 1:1 H<sub>2</sub>SO<sub>4</sub>  
 250ml conc H<sub>2</sub>SO<sub>4</sub> (EMD 49284; EXP: 11/20/14) +  
 250 ml DI H<sub>2</sub>O  
 EXP: 11/20/14

6/25/14 S24-06251402 Ferric Chloride Soln  
 100g FeCl<sub>3</sub> · 6H<sub>2</sub>O (Mallinckrodt J13631;  
 EXPI 9/25/15)  
 EXP: 6/25/15

6/25/14 S24-06251403 Sulfanilamide Soln  
 5.00g Sulfanilamide (JT Baker lot J32618; EXP 11/6/11)  
 DISSOLVED IN 50ml conc HCl (EMP lot # 49200;  
 EXP: 2/7/16) ↑ 500ml w/ DI H<sub>2</sub>O  
 EXP: 6/25/15

6/25/14 S24-06251404 AMINE Soln  
 SLOWLY ADD 6.25ml conc H<sub>2</sub>SO<sub>4</sub> (EMD 49284;  
 EXP: 11/20/14) TO 2.5ml DI. EtOH.  
 DISSOLVE 1.6875g N,N-dimethyl-1,4-phenylene  
 diamine oxalat (ALDRICH MCR57841V; EXP:  
 5/24/16) IN ABOVE ACID Soln then dilute  
 to 250 ml w/ 1:1 H<sub>2</sub>SO<sub>4</sub> (S24-06251401;  
 EXP: 11/20/14).  
 EXP: 0725/14

9/8/14 SZ4-0908/401 0.1 N H<sub>2</sub>SO<sub>4</sub>  
 5.6 ml conc. H<sub>2</sub>SO<sub>4</sub> (EMD 49284; EXP: 11/20/14)  
 ↑ 2L w/ DI H<sub>2</sub>O  
 EXP: 11/20/14

9/8/14 SZ4-0908/402 1.0 N NaOH  
 8.0 g NaOH (EMD B0630569 12/13) ↑ 200 ml  
 w/ DI H<sub>2</sub>O  
 EXP: 9/8/15

9/15/14 SZ4-0915/401 H<sub>2</sub>S radiello stock  
 Purchased Sigma Aldrich  
 RAD 171 100 ml Amber GLASS  
 LOT # 14279102 CAT # RAD 171  
 Prepped 1:50 ⇒ 1.145 µg/ml Sulfide  
 EXP: 9/2/15

#### Calibration solution for Hydrogen Sulphide (code RAD171)

CAUTION: Do not swallow. Wash the hands thoroughly after use. Avoid contact with the eyes, skin and clothes. In case of contact with eyes, flush with large amounts of running water for at least 15 minutes. See MSDS for complete safety information.

#### Description

Code RAD171 relieves you from the task of preparing the sodium sulfide standard solution for the calibration curve used for the determination of H<sub>2</sub>S by the cartridge code RAD170.  
 Since sodium sulfide is deliquescent, its weight is not a primary standard and sodium sulfide solution need titration once prepared. Moreover, solution must be repeated often due to the instability of diluted solution (one hour time is sufficient to decrease sulfide content by 10%).  
 Code RAD171 is a methylene blue concentrated solution that, once diluted 1:50, provides the same absorbance value at 665 nm of a sodium sulfide solution of with concentration 1.145 µg·ml<sup>-1</sup> sulfide ions.  
 This concentration value has been chosen to obtain the highest absorbance value within the linearity range of the spectrophotometer.  
 To obtain a complete calibration curve, just dilute the mother solution as shown in the table.

Solution	ml of	ml of water	equivalent to µg·ml <sup>-1</sup> of S <sup>2-</sup>
A	2 of code RAD171	98	1.145
B	25 of A	25	0.572
C	10 of A	40	0.229
D	5 of A	45	0.115

Code RAD171 allows you to prepare as many as 50 calibration curves.

#### Storage

Store in original containers or other appropriately labeled, suitable containers.  
 Kept in a cool, dry environment away from sources of heat code RAD171 solution is stable for at least one year.



2/4/15 S24-02041501 0.1 N H<sub>2</sub>SO<sub>4</sub>  
 5.6 ml Conc H<sub>2</sub>SO<sub>4</sub> (CND 54174; EXP: 11/7/19)  
 ↑ 2L w/ DI H<sub>2</sub>O  
 EXP: 2/4/16

2/4/15 S24-02041502 1000 PPM NH<sub>3</sub> stock  
 0.3141g NH<sub>4</sub>Cl (CND WJ11C; EXP: 6/5/19)  
 ↑ 100ml w/ S24-02041501.  
 EXP: 8/4/15

2/5/15 S24-02051501 0.1 N H<sub>2</sub>SO<sub>4</sub>  
 5.6ml Conc H<sub>2</sub>SO<sub>4</sub> (CND 54174; EXP: 11/7/19)  
 ↑ 2L w/ DI H<sub>2</sub>O  
 EXP: 2/5/16

2/10/15 S24-02101501 1:1 H<sub>2</sub>SO<sub>4</sub>  
 250 ml DI + 250ml Conc H<sub>2</sub>SO<sub>4</sub>  
 (CND 54174; EXP: 11/7/19) let cool  
 EXP: 2/10/16

2/10/15 S24-02101502 AMINE Soln  
 slowly add 6.25ml Conc H<sub>2</sub>SO<sub>4</sub> (CND 54174;  
 EXP: 11/7/19) to 2.5 ml DI H<sub>2</sub>O. let cool  
 Dissolve 1.6875g N,N-Dimethyl-1,4-phenylenediamine oxalate  
 (Aldrich MKB7824W; EXP: 5/24/16) in ABOVE ACID SOLN. THEN  
 dilute to 250ml w/ 1:1 H<sub>2</sub>SO<sub>4</sub> (S24-02101501; 2/10/16)  
 EXP: 2/10/16

**Tetra Tech, Inc.**  
**DATA VALIDATION REPORT**  
**LEVEL II**

Site: West Lake Landfill Site, Bridgeton, Missouri

Laboratory: ALS Environmental (Simi Valley, California)

Data Reviewer: Harry Ellis, Tetra Tech, Inc. (Tetra Tech)

Review Date: February 25, 2015

Sample Delivery Group (SDG): P15000481

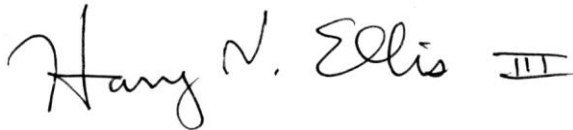
Sample Numbers: WAA-01-RH-PS-20150204, WAA-02-RH-PS-20150204, WAA-03-RH-PS-20150204, WAA-04-RH-PS-20150204, WAA-04-RH-DU-20150204, WAA-05-RH-PS-20150204, and WAA-00-RH-TB-20150204

Matrix / Number of Samples: 5 Air Samples, 1 Field Duplicate Sample, and 1 Trip Blank

The data were qualified according to the U.S. Environmental Protection Agency (EPA) Region 7 documents entitled "Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review" (9240.1-48), June 2008. In addition, the Tetra Tech document "Review of Data Packages from Subcontracted Laboratories" (February 2002) was used along with other criteria specified in the applicable methods.

The review was intended to identify problems and quality control (QC) deficiencies that were readily apparent from the summary data package. The following sections discuss any problems or deficiencies that were found, and data qualifications applied because of non-compliant QC. The data review was limited to the available field and laboratory QC information submitted with the project-specific data package.

I, Harry Ellis, certify that all data validation criteria outlined in the above-referenced documents were assessed, and any qualifications made to the data accorded with those documents.



25 February 2015

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Certified by Harry Ellis, Chemist

---

Date

## DATA VALIDATION QUALIFIERS

- U** — The analyte was not detected above the reported sample quantitation limit.
- J** — The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.
- UJ** — The analyte was not detected above the reported sample quantitation limit, which is estimated.
- R** — The sample results are rejected due to serious deficiencies in the ability to analyze the sample and meet QC criteria. Presence or absence of the analyte cannot be verified.

## **DATA ASSESSMENT**

Sample delivery group (SDG) P1500481 included five (5) environmental air (Radiello™ adsorbent tube) samples and two (2) QC samples (a field duplicate and a trip blank). Samples were analyzed for hydrogen sulfide via the laboratory's implementation of the manufacturer's method. The following summarizes the data validation that was performed.

### **VOLATILE ORGANIC COMPOUND ANALYSIS**

#### **I. Holding Time and Chain of Custody (COC) Requirements**

The samples were received by the laboratory and analyzed within the accepted holding time of 30 days from sample collection by tube to analysis. No data were qualified.

#### **II. Matrix Spike/Matrix Spike Duplicate (MS/MSD)**

MS/MSD analyses are not practical for air analyses. Satisfactory LCS and field duplicate sample analysis provided adequate data on precision and accuracy. No qualifications were applied.

#### **III. Blanks**

No analytes were detected in the laboratory (method) and field blanks. No qualifications were applied.

#### **IV. Laboratory Control Sample (LCS)**

All results for the duplicate LCS were within QC limits.

#### **V. Surrogates**

Surrogates are not used in this analysis.

#### **VI. Comments**

All detected results in the field samples were less than the sample reporting limits, which correspond to the lowest calibration standard. The laboratory correctly qualified these results as estimated and flagged them "J". All detected results, including the field duplicate pair, were quite similar.

#### **VII. Overall Assessment of Data**

Overall data quality is acceptable, with no qualifications added. All data are usable as reported for their intended purposes.

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## LABORATORY REPORT

February 17, 2015

Rob Monnig  
Tetra Tech, Incorporated  
415 Oak Street  
Kansas City, MO 64106

**RE: West Lake Landfill / 103X9025140058**

Dear Rob:

Enclosed are the results of the samples submitted to our laboratory on February 6, 2015. For your reference, these analyses have been assigned our service request number P1500481.

All analyses were performed according to our laboratory's NELAP and DoD-ELAP-approved quality assurance program. The test results meet requirements of the current NELAP and DoD-ELAP standards, where applicable, and except as noted in the laboratory case narrative provided. For a specific list of NELAP and DoD-ELAP-accredited analytes, refer to the certifications section at [www.alsglobal.com](http://www.alsglobal.com). Results are intended to be considered in their entirety and apply only to the samples analyzed and reported herein.

If you have any questions, please call me at (805) 526-7161.

Respectfully submitted,

**ALS | Environmental**

By Sue Anderson at 10:00 am, Feb 17, 2015

Sue Anderson  
Project Manager



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[www.alsglobal.com](http://www.alsglobal.com)

Client: Tetra Tech, Incorporated  
Project: West Lake Landfill / 103X9025140058

Service Request No: P1500481

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### CASE NARRATIVE

The samples were received intact under chain of custody on February 6, 2015 and were stored in accordance with the analytical method requirements. Please refer to the sample acceptance check form for additional information. The results reported herein are applicable only to the condition of the samples at the time of sample receipt.

#### Hydrogen Sulfide in Air (H<sub>2</sub>S) Analysis

The samples were prepared in accordance with CAS AQL 110 for hydrogen sulfide in air and analyzed by colorimetric method using a spectrophotometer. This method is not included on the laboratory's NELAP, DoD-ELAP, or AIHA-LAP scope of accreditation.

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*The results of analyses are given in the attached laboratory report. All results are intended to be considered in their entirety, and ALS Environmental (ALS) is not responsible for utilization of less than the complete report.*

*Use of ALS Environmental (ALS)'s Name. Client shall not use ALS's name or trademark in any marketing or reporting materials, press releases or in any other manner ("Materials") whatsoever and shall not attribute to ALS any test result, tolerance or specification derived from ALS's data ("Attribution") without ALS's prior written consent, which may be withheld by ALS for any reason in its sole discretion. To request ALS's consent, Client shall provide copies of the proposed Materials or Attribution and describe in writing Client's proposed use of such Materials or Attribution. If ALS has not provided written approval of the Materials or Attribution within ten (10) days of receipt from Client, Client's request to use ALS's name or trademark in any Materials or Attribution shall be deemed denied. ALS may, in its discretion, reasonably charge Client for its time in reviewing Materials or Attribution requests. Client acknowledges and agrees that the unauthorized use of ALS's name or trademark may cause ALS to incur irreparable harm for which the recovery of money damages will be inadequate. Accordingly, Client acknowledges and agrees that a violation shall justify preliminary injunctive relief. For questions contact the laboratory.*



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ALS Environmental – Simi Valley

CERTIFICATIONS, ACCREDITATIONS, AND REGISTRATIONS

Agency	Web Site	Number
AIHA	<a href="http://www.aihaaccreditedlabs.org">http://www.aihaaccreditedlabs.org</a>	101661
Arizona DHS	<a href="http://www.azdhs.gov/lab/license/env.htm">http://www.azdhs.gov/lab/license/env.htm</a>	AZ0694
DoD ELAP	<a href="http://www.pjlabs.com/search-accredited-labs">http://www.pjlabs.com/search-accredited-labs</a>	L14-2
Florida DOH (NELAP)	<a href="http://www.doh.state.fl.us/lab/EnvLabCert/WaterCert.htm">http://www.doh.state.fl.us/lab/EnvLabCert/WaterCert.htm</a>	E871020
Maine DHHS	<a href="http://www.maine.gov/dhhs/mecdc/environmental-health/water/dwp-services/labcert/labcert.htm">http://www.maine.gov/dhhs/mecdc/environmental-health/water/dwp-services/labcert/labcert.htm</a>	2014025
Minnesota DOH (NELAP)	<a href="http://www.health.state.mn.us/accreditation">http://www.health.state.mn.us/accreditation</a>	838341
New Jersey DEP (NELAP)	<a href="http://www.nj.gov/dep/oqa/">http://www.nj.gov/dep/oqa/</a>	CA009
New York DOH (NELAP)	<a href="http://www.wadsworth.org/labcert/elap/elap.html">http://www.wadsworth.org/labcert/elap/elap.html</a>	11221
Oregon PHD (NELAP)	<a href="http://public.health.oregon.gov/LaboratoryServices/EnvironmentalLaboratoryAccreditation/Pages/index.aspx">http://public.health.oregon.gov/LaboratoryServices/EnvironmentalLaboratoryAccreditation/Pages/index.aspx</a>	CA200007
Pennsylvania DEP	<a href="http://www.depweb.state.pa.us/labs">http://www.depweb.state.pa.us/labs</a>	68-03307 (Registration)
Texas CEQ (NELAP)	<a href="http://www.tceq.texas.gov/field/qa/env_lab_accreditation.html">http://www.tceq.texas.gov/field/qa/env_lab_accreditation.html</a>	T104704413-14-5
Utah DOH (NELAP)	<a href="http://www.health.utah.gov/lab/labimp/certification/index.html">http://www.health.utah.gov/lab/labimp/certification/index.html</a>	CA01627201 4-4
Washington DOE	<a href="http://www.ecy.wa.gov/programs/eap/labs/lab-accreditation.html">http://www.ecy.wa.gov/programs/eap/labs/lab-accreditation.html</a>	C946

Analyses were performed according to our laboratory's NELAP and DoD-ELAP approved quality assurance program. A complete listing of specific NELAP and DoD-ELAP certified analytes can be found in the certifications section at [www.alsglobal.com](http://www.alsglobal.com), or at the accreditation body's website.

Each of the certifications listed above have an explicit Scope of Accreditation that applies to specific matrices/methods/analytes; therefore, please contact the laboratory for information corresponding to a particular certification.



## ALS ENVIRONMENTAL

### DETAIL SUMMARY REPORT

Client: Tetra Tech, Incorporated  
Project ID: West Lake Landfill / 103X9025140058

Service Request: P1500481

Date Received: 2/6/2015  
Time Received: 09:40

CAS AQL 110 - H2S Air

Client Sample ID	Lab Code	Matrix	Date Collected	Time Collected	
WAA-01-RH-PS-20150204	P1500481-001	Air	2/4/2015	14:07	X
WAA-02-RH-PS-20150204	P1500481-002	Air	2/4/2015	13:29	X
WAA-03-RH-PS-20150204	P1500481-003	Air	2/4/2015	13:50	X
WAA-04-RH-PS-20150204	P1500481-004	Air	2/4/2015	13:57	X
WAA-05-RH-PS-20150204	P1500481-005	Air	2/4/2015	13:37	X
WAA-04-RH-DU-20150204	P1500481-006	Air	2/4/2015	13:57	X
WAA-00-RH-TB-20150204	P1500481-007	Air	2/4/2015	14:14	X

## Radiello - Chain of Custody Record &amp; Analytical Service Request

Page 1 of 1



2655 Park Center Drive, Suite A  
 Simi Valley, California 93065  
 Phone (805) 526-7161  
 Fax (805) 526-7270

Requested Turnaround Time in Business Days (Surcharges) please circle 1 Day (100%) 2 Day (75%) 3 Day (50%) 4 Day (35%) 5 Day (25%) 10 Day-Standard							ALS Project No. <b>P1500481</b>		
Company Name & Address (Reporting Information) <b>Tetra Tech</b> <b>415 Oak Street,</b> <b>Kansas City, MO 64106</b>				Project Name <b>West Lake Landfill</b>			ALS Contact: <b>Sue Anderson</b>		
Project Manager <b>Rob Monnig (816-412-1775) / Dave Kinroth (314-517-6798)</b>				Project Number <b>103X9025140058</b>			Analysis: (e.g. NO <sub>2</sub> , SO <sub>2</sub> , O <sub>3</sub> , VOCs, Aldehyde, Ammonia)		
P.O. # / Credit Card / Billing Information <b>PO 1111500</b> <b>Attn: Emily Fisher</b> <b>415 Oak Street, Kansas City, MO 64106</b>				Hydrogen Sulfide			Comments		
Email Address for Result Reporting <b>emily.fisher@tetratech.com</b>				emily.fisher@tetratech.com					
Client Sample ID	Laboratory ID Number	Date/Time Start	Date/Time End	Total Sampling Time (minutes)	Sampling Temp 25°C assumed if not specified	Radiello ID Sticker Number			
WAA-01-RH-PS-20150204	①	1/28/15 @ 14:02	2/4/15 @ 14:07	10085	2.2	778HT	X		
WAA-02-RH-PS-20150204	②	1/28/15 @ 13:21	2/4/15 @ 13:29	10088	2.2	779HT	X		
WAA-03-RH-PS-20150204	③	1/28/15 @ 13:39	2/4/15 @ 13:50	10091	2.2	780HT	X		
WAA-04-RH-PS-20150204	④	1/28/15 @ 13:53	2/4/15 @ 13:57	10084	2.2	781HT	X		
WAA-05-RH-PS-20150204	⑤	1/28/15 @ 13:29	2/4/15 @ 13:37	10088	2.2	782HT	X		
WAA-04-RH-DU-20150204	⑥	1/28/15 @ 13:53	2/4/15 @ 13:57	10084	2.2	783HT	X		
WAA-00-RH-TB-20150204	⑦	1/28/15 @ 13:15	2/4/15 @ 14:14	NA	NA	784HT	X		
<b>Report Tier Levels - please select one</b> Tier I - (Results/Default if not specified) _____ Tier III (Data Validation Package) 10% Surcharge _____ EDD required Yes Tier II (Results + QC) _____ Tier V (client specified) _____ Type: _____									
Relinquished by: (Signature)							Date:	Time:	
Relinquished by: (Signature) <b>Forly</b>							Date:	Time:	
Relinquished by: (Signature)							Date:	Time:	
Received by: (Signature) <b>Forly</b>							Date:	Time:	
Received by: (Signature)							Date:	Time:	
Received by: (Signature)							Date:	Time:	
Chain of Custody Seal: (Circle) INTACT <input checked="" type="radio"/> BROKEN <input type="radio"/> ABSENT <input type="radio"/>							Project Requirements (MRLs, QAPP)		
Cooler / Blank Temperature _____ °C									

**ALS Environmental**  
**Sample Acceptance Check Form**

Client: Tetra Tech, Incorporated

Work order: P1500481

Project: West Lake Landfill / 103X9025140058

Sample(s) received on: 2/6/2015

Date opened: 2/6/2015

by: ADAVID

**Note:** This form is used for all samples received by ALS. The use of this form for custody seals is strictly meant to indicate presence/absence and not as an indication of compliance or nonconformity. Thermal preservation and pH will only be evaluated either at the request of the client and/or as required by the method/SOP.

	<b>Yes</b>	<b>No</b>	<b>N/A</b>
1 Were <b>sample containers</b> properly marked with client sample ID?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2 Container(s) <b>supplied by ALS</b> ?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3 Did <b>sample containers</b> arrive in good condition?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4 Were <b>chain-of-custody</b> papers used and filled out?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5 Did <b>sample container labels</b> and/or tags agree with custody papers?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6 Was <b>sample volume</b> received adequate for analysis?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7 Are samples within specified holding times?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8 Was proper <b>temperature</b> (thermal preservation) of cooler at receipt adhered to?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
9 Was a <b>blank tube</b> received?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10 Were <b>custody seals</b> on outside of cooler/Box?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Location of seal(s)? _____ Sealing Lid?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Were signature and date included?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Were seals intact?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Were custody seals on outside of sample container?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Location of seal(s)? _____ Sealing Lid?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Were signature and date included?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Were seals intact?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
11 Do containers have appropriate <b>preservation</b> , according to method/SOP or Client specified information?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Is there a client indication that the submitted samples are <b>pH</b> preserved?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Were <b>VOA vials</b> checked for presence/absence of air bubbles?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Does the client/method/SOP require that the analyst check the sample pH and <u>if necessary</u> alter it?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
12 <b>Tubes:</b> Are the tubes capped and intact?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Do they contain moisture?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
13 <b>Badges:</b> Are the badges properly capped and intact?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Are dual bed badges separated and individually capped and intact?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

Lab Sample ID	Container Description	Required pH *	Received pH	Adjusted pH	VOA Headspace (Presence/Absence)	Receipt / Preservation Comments
P1500481-001.01	Passive (Radiello H2S)					
P1500481-002.01	Passive (Radiello H2S)					
P1500481-003.01	Passive (Radiello H2S)					
P1500481-004.01	Passive (Radiello H2S)					
P1500481-005.01	Passive (Radiello H2S)					
P1500481-006.01	Passive (Radiello H2S)					
P1500481-007.01	Passive (Radiello H2S)					

Explain any discrepancies: (include lab sample ID numbers): \_\_\_\_\_

# ALS ENVIRONMENTAL

## RESULTS OF ANALYSIS

Page 1 of 1

**Client:** Tetra Tech, Incorporated  
**Client Project ID:** West Lake Landfill / 103X9025140058

ALS Project ID: P1500481

## Hydrogen Sulfide

**Test Code:** ALS AQL 110  
**Instrument ID:** P-UV-Vis-01  
**Analyst:** Sue Anderson  
**Sampling Media:** Radiello Tube(s)  
**Test Notes:**

**Date(s) Collected:** 2/4/15  
**Date Received:** 2/6/15  
**Date Extracted:** 2/11/15  
**Date Analyzed:** 2/11/15  
**Desorption Volume:** 0.010 Liter(s)

Client Sample ID	ALS Sample ID	Sampling		Result ng/Sample	MRL ng/Sample	MDL ng/Sample	Result µg/m³	MRL µg/m³	MDL µg/m³	Data Qualifier
		Time Minutes	Dilution Factor							
WAA-01-RH-PS-20150204	P1500481-001	10085	1.0	160	570	110	0.31	1.1	0.21	J
WAA-02-RH-PS-20150204	P1500481-002	10088	1.0	120	570	110	0.24	1.1	0.21	J
WAA-03-RH-PS-20150204	P1500481-003	10091	1.0	ND	570	110	ND	1.1	0.21	
WAA-04-RH-PS-20150204	P1500481-004	10084	1.0	140	570	110	0.28	1.1	0.21	J
WAA-05-RH-PS-20150204	P1500481-005	10088	1.0	130	570	110	0.26	1.1	0.21	J
WAA-04-RH-DU-20150204	P1500481-006	10084	1.0	140	570	110	0.28	1.1	0.21	J
WAA-00-RH-TB-20150204	P1500481-007	NA	1.0	ND	570	110	NA	NA	NA	
Method Blank	P150211-MB	NA	1.0	ND	570	110	NA	NA	NA	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

NA = Not applicable.

J = The result is an estimated concentration that is less than the MRL but greater than or equal to the MDL.

HVE  
 25 Feb 2015

# ALS ENVIRONMENTAL

## RESULTS OF ANALYSIS

Page 1 of 1

**Client:** Tetra Tech, Incorporated  
**Client Sample ID:** Duplicate Lab Control Sample  
**Client Project ID:** West Lake Landfill / 103X9025140058

ALS Project ID: P1500481  
ALS Sample ID: P150211-LCS,  
P150211-DLCS

### Laboratory Control Sample/Duplicate Laboratory Control Sample Summary

**Test Code:** ALS AQL 110  
**Instrument ID:** P-UV-Vis-01  
**Analyst:** Sue Anderson  
**Sampling Media:** Radiello Tube(s)  
**Test Notes:**

**Date Sampled:** NA  
**Date Received:** NA  
**Date Analyzed:** 2/11/15  
**Volume(s) Analyzed:** NA

Compound	Spike Amount	Result		% Recovery		ALS Acceptance Limits	Relative Percent Difference	RPD Limit	Data Qualifier
	LCS / DLCS µg/L	LCS µg/L	DLCS µg/L	LCS	DLCS				
Hydrogen Sulfide	500	549	545	110	109	73-129	1	5	



Environmental

# Hydrogen Sulfide (H<sub>2</sub>S) in Air Bench Sheet

ACS AQL 110

Service Request#: P1500342 P1500481

Prep Run #: 229115

Run #: 432468 page 1 of 2

	Ref #	Concentration (ug/L)	Exp. Date
RAD 171 Stock	524-09151401	57250 ug/L	9/2/15
Sulfide ICV/CCV	524-04081401	500 ug/L	4/8/15

Reagents	Reference or Lot #	Exp. Date	Coloring Solution
Ferric Chloride	524-0627402	6/25/15	10 mL Ferric Cl + 50 mL Amino Sulfuric
Amino Sulfuric	524-07101502	2/10/16	prepped prior to coloring step
radiello Tube	14315	01/15	

Calibration Curve: RAD 171 diluted to volume with Deionized Water

10 mL aliquot of each Prep run	NA	0.05 / 50	0.10 / 50	0.20 / 50	0.50 / 50	0.75 / 50	1.0 / 50	Corr. Coeff			
ug/L (ppb)	0	57.3	115	229	573	859	1145	0.99957443			
Abs. @ 665 nm	0.000	0.054	0.122	0.234	0.574	0.866	1.144	DE CORRECTED			
								Temp Corrected			
Sample ID	Sampling Time (mins)	Temp	Extract Volume (L)	Dilution	Blank Subtract Abs.	Absorbance @ 665 nm	Corrected Abs.*	Result ug/L (ppb)	Result ng/sample	Result H <sub>2</sub> S ppbV**	Result ug/m <sup>3</sup> ***
ICB	—	—	—	—	—	0.000	0.000	-2.05/11.6	11.6		
ICV 500ug/L	—	—	—	—	—	0.534	0.534	532			106
MB1	—	25°C	0.010	—	—	0.013	0.013	10.9/11.6	11.6		
MB2	—	—	—	—	—	0.013	0.013	10.9/11.6	11.6		
LCS 500ug/L	—	—	—	—	0.013	0.0470.574	0.581	570.69	570.69	5447	110
DLS I	—	—	—	—	—	0.0430.574	0.577	574.69	574.69	5447	109%
P1500342-1.0/	12961	3.3°C	—	—	—	0.0480.047	0.034	31.931	302.667	0.32	0.45
—2.0/	12967	—	—	—	—	0.0570.043	0.020	27.933	264.769	0.28	0.40
—3.0/	12959	—	—	—	—	0.0330.042	0.029	26.934	255.295	0.27	0.38
—4.0/	12961	—	—	—	—	0.057	0.044	41.922	397.412	0.43	0.59
—5.0/	12964	—	—	—	—	0.033	0.020	17.938	170.024	0.18	0.25
—6.0/	12961	—	—	—	—	0.044	0.031	28.933	274.244	0.29	0.41
CCV 500ug/L	—	—	—	—	—	0.532	0.532	530			106
CCB1	—	—	—	—	—	0.000	0.000	-2.05/11.6			

\*Concentration after blank subtraction (as applicable)

Comments:\*\*H<sub>2</sub>S in ppbV = ng H<sub>2</sub>S / (0.096 ng/ppb · min) x time in minutes; \*\*\*ug/m<sup>3</sup> = ppbV H<sub>2</sub>S x (34.09 MW of H<sub>2</sub>S / 24.46 gas constant)

LCS (500 ug/L): spike tube with 0.5 ml of freshly prepped 10 ppm sulfide solution [0.0764g Sodium Sulfide up to 1L with DI] up to 10 mL desorb volume

Prepped By: SA

Analyzed By: SA

Reviewed By: SA

Date: 2/11/15 C 1240  
Date: 2/11/15 C 1310  
Date: 2/11/15

TEMP CORRECTION =  $\left(\frac{K}{298}\right)^{38}$   
APPLY TO ALL SAMPLING RATE



ALS Environmental

Service Request#:

# Hydrogen Sulfide (H<sub>2</sub>S) in Air Bench Sheet

ACS AQL 110

Prep Run #:

Run #:

Page 2 of 2

	Ref #	Concentration (ug/L)	Exp. Date
RAD 171 Stock	524-0915401	57250 ug/L	9/2/15
Sulfide ICV/CCV	524-04081401	500 ug/L	4/8/15

Reagents	Reference or Lot #	Exp. Date	Coloring Solution
Ferric Chloride	524-06051402	6/25/15	10 mL Ferric Cl + 50 mL Amino Sulfuric prepped prior to coloring step
Amino Sulfuric	524-02101502	2/10/16	
radiello Tube	14315	09/15	

Calibration Curve: RAD 171 diluted to volume with Deionized Water

10 mL aliquot of each Prep run	NA	0.05 / 50	0.10 / 50	0.20 / 50	0.50 / 50	0.75 / 50	1.0 / 50	Corr. Coeff			
ug/L (ppb)	0	57.3	115	229	573	859	1145				
Abs. @ 665 nm	0.000	0.054	0.122	0.234	0.574	0.866	1.144	0.999957443			
									Temp. Corrected		
Sample ID	Sampling Time (mins)	Temp	Extract Volume (L)	Dilution	Blank Subtract Abs.	Absorbance @ 665 nm	Corrected Abs.*	Result ug/L (ppb)	Result ng/sample	Result H <sub>2</sub> S ppbV**	Result ug/m <sup>3</sup> ***
P150342-7.01	0	NA	0.010	—	0.013	0.014	0.001	-1.05/41.6	110		
P150348-1.01	10085	21.2°C	—	—	—	0.032	0.019	16.938	160.550	0.22	0.31
-2.01	10088	—	—	—	—	0.028	0.015	12.940	122.652	0.17	0.24
-3.01	10091	—	—	—	—	0.026	0.013	10.9/41.6	110	10.16	10.22
-4.01	10084	—	—	—	—	0.030	0.017	14.939	141.601	0.20	0.28
-5.01	10088	—	—	—	—	0.029	0.016	13.939	132.127	0.18	0.26
-6.01	10084	—	—	—	—	0.030	0.017	14.939	141.601	0.20	0.28
-7.01	0	NA	—	—	—	0.013	0.000	-2.05/41.6	110		
CCV 2 500 ug/L	—	—	—	—	—	0.532	0.532	530			106%
CU50	—	—	—	—	—	0.000	0.000	-2.05/41.6			

ICV/CCV Acceptance Criteria: 90-110%

LCS/DLCS Acceptance Criteria: 73-129%

RPD Acceptance Criteria: ≤ 5%

Note: the results as calculated on the Bench Sheet may vary slightly than what is reported due to sig figs used for calculation.

\*Concentration after blank subtraction (as applicable)

Comments: \*\*H<sub>2</sub>S in ppbV = ng H<sub>2</sub>S / (0.096 ng/ppb · min) x time in minutes; \*\*\*ug/m<sup>3</sup> = ppbV H<sub>2</sub>S x (34.09 MW of H<sub>2</sub>S / 24.46 gas constant)

LCS (500 ug/L): spike tube with 0.5 ml of freshly prepped 10 ppm sulfide solution [0.0764g Sodium Sulfide up to 1L with DI] up to 10 mL desorb volume

Prepped By:

Analyzed By:

Reviewed By:

Date:

Date:

Date:

TEMP CORRECTION =  $\left(\frac{K}{298}\right)^{3.8}$   
APPLY TO ALL SAMPLING RATE



3/18/14 524-03181401 500PM NO2  
 Purchased  
 Ricca Chemical Company Cat No 5444.5-4  
 Lot # 2403762 120ml Amber glass  
 Exp: 9/20/14

3/20/14 524-03201401 0.1 N H2SO4  
 5.6 ml conc H2SO4 (EMD 49284; Exp:  
 11/20/14) ↑ 2L w/ DI  
 Exp: 11/20/14

4/8/14 524-04081401 Methylene Blue 2% Sol  
 100ml, purchased 4/8/14 2425000 13 L  
 Alfa Aesar Lot K206010 2500000  
 Exp: 4/8/15

4/8/14 524-04081402 0.1 N H2SO4  
 5.6 ml conc H2SO4 (EMD 49284; Exp:  
 11/20/14) ↑ 2L w/ DI H2O  
 Exp: 11/20/14

4/22/14 524-04221401 1000ppm SO3 Stock  
 0.1591g Na2SO3 (JT Baker Lot # H10627; Exp: 8/31)  
 ↑ 100ml w/ DI H2O.  
 Exp: 5/6/14



6/25/14 S24-06251401 1:1 H<sub>2</sub>SO<sub>4</sub>  
 250ml conc H<sub>2</sub>SO<sub>4</sub> (EMD 49284; EXP: 11/20/14) +  
 250 ml DI H<sub>2</sub>O  
 EXP: 11/20/14

6/25/14 S24-06251402 Ferric Chloride Soln  
 100g FeCl<sub>3</sub> · 6H<sub>2</sub>O (Mallinckrodt J13631;  
 EXPI 9/25/15)  
 EXP: 6/25/15

6/25/14 S24-06251403 Sulfanilamide Soln  
 5.00g Sulfanilamide (JT Baker lot J32618; EXP 11/6/11)  
 DISSOLVED IN 50ml conc HCl (EMP lot # 49200;  
 EXP: 2/7/16) ↑ 500ml w/ DI H<sub>2</sub>O  
 EXP: 6/25/15

6/25/14 S24-06251404 AMINE Soln  
 SLOWLY ADD 6.25ml conc H<sub>2</sub>SO<sub>4</sub> (EMD 49284;  
 EXP: 11/20/14) TO 2.5ml DI. EtOH.  
 DISSOLVE 1.6875g N,N-dimethyl-1,4-phenylene  
 diamine oxalate (ALDRICH MCR57841V; EXP:  
 5/24/16) IN ABOVE ACID Soln then dilute  
 to 250 ml w/ 1:1 H<sub>2</sub>SO<sub>4</sub> (S24-06251401;  
 EXP: 11/20/14).  
 EXP: 0725/14

9/8/14 SZ4-0908/401 0.1 N H<sub>2</sub>SO<sub>4</sub>  
 5.6 ml conc. H<sub>2</sub>SO<sub>4</sub> (EMD 49284; EXP: 11/20/14)  
 ↑ 2L w/ DI H<sub>2</sub>O  
 EXP: 11/20/14

9/8/14 SZ4-0908/402 1.0 N NaOH  
 8.0 g NaOH (EMD B0630569 12/13) ↑ 200 ml  
 w/ DI H<sub>2</sub>O  
 EXP: 9/8/15

9/15/14 SZ4-0915/401 H<sub>2</sub>S radiello stock  
 Purchased Sigma Aldrich  
 RAD 171 100 ml Amber GLASS  
 LOT # 14279102 CAT # RAD 171  
 Prepped 1:50 ⇒ 1.145 µg/ml Sulfide  
 EXP: 9/2/15

#### Calibration solution for Hydrogen Sulphide (code RAD171)

CAUTION: Do not swallow. Wash the hands thoroughly after use. Avoid contact with the eyes, skin and clothes. In case of contact with eyes, flush with large amounts of running water for at least 15 minutes. See MSDS for complete safety information.

#### Description

Code RAD171 relieves you from the task of preparing the sodium sulfide standard solution for the calibration curve used for the determination of H<sub>2</sub>S by the cartridge code RAD170.  
 Since sodium sulfide is deliquescent, its weight is not a primary standard and sodium sulfide solution need titration once prepared. Moreover, solution must be repeated often due to the instability of diluted solution (one hour time is sufficient to decrease sulfide content by 10%).  
 Code RAD171 is a methylene blue concentrated solution that, once diluted 1:50, provides the same absorbance value at 665 nm of a sodium sulfide solution of with concentration 1.145 µg·ml<sup>-1</sup> sulfide ions.  
 This concentration value has been chosen to obtain the highest absorbance value within the linearity range of the spectrophotometer.  
 To obtain a complete calibration curve, just dilute the mother solution as shown in the table.

Solution	ml of	ml of water	equivalent to µg·ml <sup>-1</sup> of S <sup>2-</sup>
A	2 of code RAD171	98	1.145
B	25 of A	25	0.572
C	10 of A	40	0.229
D	5 of A	45	0.115

Code RAD171 allows you to prepare as many as 50 calibration curves.

#### Storage

Store in original containers or other appropriately labeled, suitable containers.  
 Kept in a cool, dry environment away from sources of heat code RAD171 solution is stable for at least one year.

2/4/15 S24-02041501 0.1 N H<sub>2</sub>SO<sub>4</sub>  
 5.6 ml Conc H<sub>2</sub>SO<sub>4</sub> (CND 54174; EXP: 11/7/19)  
 ↑ 2L w/ DI H<sub>2</sub>O  
 EXP: 2/4/16

2/4/15 S24-02041502 1000 PPM NH<sub>3</sub> stock  
 0.3141g NH<sub>4</sub>Cl (CND WJ11C; EXP: 6/5/19)  
 ↑ 100ml w/ S24-02041501.  
 EXP: 8/4/15

2/5/15 S24-02051501 0.1 N H<sub>2</sub>SO<sub>4</sub>  
 5.6ml Conc H<sub>2</sub>SO<sub>4</sub> (CND 54174; EXP: 11/7/19)  
 ↑ 2L w/ DI H<sub>2</sub>O  
 EXP: 2/5/16

2/10/15 S24-02101501 1:1 H<sub>2</sub>SO<sub>4</sub>  
 250ml DI + 250ml Conc H<sub>2</sub>SO<sub>4</sub>  
 (CND 54174; EXP: 11/7/19) let cool  
 EXP: 2/10/16

2/10/15 S24-02101502 AMINE Soln  
 slowly add 6.25ml Conc H<sub>2</sub>SO<sub>4</sub> (CND 54174;  
 EXP: 11/7/19) to 2.5ml DI H<sub>2</sub>O. let cool  
 Dissolve 1.6875g N,N-Dimethyl-1,4-phenylenediamine oxalate  
 (Aldrich MKB7824W; EXP: 5/24/16) in ABOVE ACID SOLN. THEN  
 dilute to 250ml w/ 1:1 H<sub>2</sub>SO<sub>4</sub> (S24-02101501; 2/10/16)  
 EXP: 2/10/16